ELECTRICAL REVIEW

and WESTERN ELECTRICIAN with which is consolidated ELECTROCRAFT

VOL. 70. CHICAGO, SATURDAY, FEBRUARY 17, 1917 No. 7

Preparedness of the Central-Station Industry

TODAY the country stands at the brink of an unknown situation, one that has passed beyond the country's ability to control. The future is pregnant with uncertainties; at any moment latent possibilities may arise to become stern realities. While uncertainty lurks broadcast over the land everywhere is to be found feverish excitement and frenzied effort in preparation for whatever the future may have in store. It is a time when much has to be done, when the time in which to do it may be short. Forced outputs are the order of the day.

Industries, men and material are being hastily mobilized to the echo of commerce, the clatter of industry and the triumphant sound of national prosperity and pride. Past deeds and future aspirations are being heralded to encourage and inspire. The country is tense with activity. Today is to be found co-operation where once was competition, unity of action and purpose today exist where yesterday were to be found discord and inefficiency. All are working for one purpose—the country's needs.

All the talk and enthusiasm and publicity of what is transpiring and the hoped-for accomplishments are, no doubt, all to good purpose since the real work goes on. But amidst the spectacular, the noise and the distraction of sensation mongers and the lovers of publicity, equally important and more deserving things may go unrecognized, and may grow up amongst us unheralded, without triumph and no songs to sing their praise. One such is the central-station industry.

The central-station industry stands prepared, already mobilized, ready to serve the individual, the community and the nation, whether for peace or war. Solidly and surely founded it stands, the central-station industry, not the creation of a moment's hasty frenzied action, but the evolution of wise, far-sighted policies, careful and painstaking development and judicious fostering. Long since have intensive co-operation and unified effort been the keynotes for the cheap and reliable generation, transmission and utilization of electrical energy. Unification of effort has come out of duplication, co-operation has grown out of competition, and efficient monopoly has absorbed the agglomerations of concerns of all sorts and sizes, giving us what we have today—cheap, reliable power, flexible, ever ready in bulk or the smallest quantity.

Out of war-stricken Europe word has come from time to time of the value of central-station service, of how it has made possible the conservation of materials of the warring nations, of how it has enabled forced production to be obtained where existed a scarcity of labor and time was short. This country is fortunate in the extreme in not knowing the stress of necessity that arises from the insatiate demands of war in our midst. We are fortunate indeed in being privileged to be able to watch and learn afar lessons being taught by the dire suffering and agony of others.

Peace or war, the central-station industry is mobilized in readiness to serve, the individual, the community and the nation. Take advantage of it now, for there is no time like the present, and this applies with more than usual truth in the present instance. Extensions to existing plants are handicapped by the scarcity of machinery and inability to obtain immediate or quick deliveries. It will in the majority of cases be found quicker, cheaper and eventually the more pleasing to resort to central-station service. The nation-wide coal shortage is driving many to central-station service. The larger the consumer the less likely is he to suffer from coal shortage because he is better able to guard against embargoes, congested railroads and those other factors causing erratic deliveries, sporadic famines and fluctuating prices. The user of central-station service is practically immune from the condition of the coal market, whereas the owner of an isolated plant is constantly faced with the problems of reduced working hours, restricted outputs, fluctuating costs and uncertain deliveries. He usually cares nothing, the more the pity, for his generating plant—it is only a means to an end—and yet at such times it is the all-important factor in deciding the performance of his plant and the cost of manufacturing his wares.

Increased outputs, overloads, long hours and overtime are the order of the day. Plants are now working as they never worked before. Increased capacity is needed sorely to meet unprecedented demands at very favorable prices with the promise of pleasing profits. Investment must be kept down, however, perhaps because capital is lacking, or since the present industrial activity is recognized as being but transitory. Possibly extensions to existing plants are needed, but machinery cannot be obtained until too late. The solution is to resort to central-station service, available without costly delays and without the necessity of finding extensive capital, which in any case can be better utilized in other ways. These are the reasons that explain why vast numbers of industrial concerns are flocking to central-station service, entirely or in part. Many are finding the present time particularly opportune to abolish their isolated plant and substitute central-station energy entirely because the price of scrap metal is high, as high

as it may reasonably be expected to attain, and selling their isolated plant now realizes handsome profit in addition to the economy and convenience that accrue in the way of greater available space, lower energy charges, etc., from central-station service.

It is only through specialization that one can excel. It is only by specialization in the generation, transmission and utilization of electrical energy that the central-station has attained the high degree of reliability and economy that it has today. By utilizing central-station service the user is free to specialize in his undertaking, at the same time benefiting at small expense from the specialized power supply, and without the inherent responsibilities and worries. The central-station industry has prospered, because it has proved itself a convenience, an economy, a necessity. It furnishes reliable flexible energy at low rates, in vast or small quantities as required at a moment's notice at a price that rarely permits of competition. It is ever ready, in readiness to serve. So thoroughly has central-station energy proved itself that last year the demands for service so far exceeded the capacity that orders were placed for 2,000,000 kilowatts in steam turbines and 400,000 kilowatts in water turbines to be delivered this year and next. Last year the earnings from central-station service exceeded $450,000,000, and would have been still greater had it been possible to connect up all the loads that offered themselves. These facts are spectacular, for those that have minds that can comprehend their import. These facts can be interpreted in but one way to mean one thing. They forcibly emphasize the fact that "he profits most who serves best."

Seasonable Appliance Campaigns

THERE is particular appeal to a campaign for the sale of electrical devices for the sick room at a time when the greatest amount of illness prevails; likewise the electric vacuum cleaner is bound to receive greatest consideration in the early spring or late fall, when housecleaning is in order. Even the electric iron, which is the most widely used of all electric appliances, is more readily sold in hot weather, when its advantages of comfort to the user are most pronounced.

The significance of this timeliness, which extends to practically all appliances, is rapidly being realized by dealers, with the result that in many cases campaigns for each month in the year have been planned well in advance, enabling goods to be ordered, advertising to be prepared and other arrangements made that will insure the greatest returns.

Electrical dealers are practically all agreed that this item of timeliness is a distinct merchandising asset, and since the selection of appliances to be featured is almost identical in those instances where plans have been announced, the question arises: why cannot these merchandising efforts be co-ordinated by the entire electrical industry, making the monthly campaign of national scope? If the national advertising of the manufacturers in March, for instance, called attention to vacuum cleaners, if all jobbers through advertising and their sales organizations featured cleaners and if every central station, dealer and contractor conducted a vacuum-cleaner campaign during the same month, utilizing all the agencies for bringing the merits of the vacuum cleaner before the public, there is no question but that the sale of these appliances would receive tremendous impetus. And so, also, could other appliances be featured on a national scale.

Precedent for such co-operative activity has already been established by the electrical industry, notably by Electrical Prosperity Week in 1915, Wire-Your-Home Month in the spring, 1916, and America's Electrical Week of 1916. Individual manufacturers have also demonstrated the possibilities in this direction by encouraging dealers through prize contests to participate in their national campaigns. The window-display contest of the National Lamp Works and the fan campaign of the Western Electric Company, mentioned in this issue, are excellent examples. Certainly dealers can well afford to enter into such co-operative movements with the manufacturers and if these efforts were truly made national by the co-operation of all manufacturers, all jobbers and all retailers, it is obvious that the results would be enormous.

A committee of the National Electric Light Association is at present investigating the possibilities of co-ordinating appliance sales. Manifestly the subject is an important one and should be given serious consideration by the entire industry.

Reputation Hurt by Confusion in Published Figures

PUBLIC service corporations are often subjected to ordeals that tend to compromise them in the minds of the people of the community which they serve, when under the scrutiny of investigators seeking to bring about a reduction in rates for service; and often this misfortune results from the manner, rather than the substance, of objections levied at the corporation.

An example is furnished in connection with recent hearings before a state board, sitting to determine the fairness of a lighting company's rates in an Eastern city. Experts employed by the city presented figures to show the excessive investment charges of the company. A difference between these and the company's recorded costs made it seem "at first blush" that the company was subjecting the city to excessive investment charges. The daily newspapers, as ever delighting in antitheses, made capital of the figures. The company's stock, as a result, dropped several points, though its earning power was not impaired and not even threatened. A later hearing brought out the information from the company that the city's figures and its own were based on different groupings of items, the totals of which were not far apart. The corrected "disclosures" of course attracted little attention, for there was no "news interest" in them.

The lesson is, that in such contests the parties should be scrupulously careful to compare like things with like. Otherwise false impressions are likely to be spread abroad, to the undeserved hurt of the utility.

HAPPENINGS IN THE INDUSTRY

Tribute to Thomas Edison from the President—Arthur Williams Heads New York Jovians—Kings County Annual Report—Middle West Company Declares Dividend—Electric Vehicle Activity in Kansas City—Prizes to Help Make Better Fan Merchants—Commission Proposed for Texas—Miscellaneous News Notes

PRESIDENT WILSON PAYS TRIBUTE TO THOMAS EDISON.

Letter Received During Testimonial Banquet in Honor of Inventor's Seventieth Birthday.

In excellent health, Thomas A. Edison celebrated his seventieth birthday on February 11. On February 10, a testimonial banquet was given to him at which a letter from President Wilson regretting his inability to be present excited an impressive demonstration of patriotism by officials and employees of the Edison affiliated industries.

"I wish with all my heart that I might be present to take part in celebrating Mr. Edison's seventieth birthday," President Wilson wrote.

"It would be a real pleasure to be able to say in public with what deep and genuine admiration I have followed his remarkable career of achievement. I was an undergraduate at the university when his first inventions captured the imagination of the world, and ever since then I have retained the sense of magic which what he did then created in my mind.

"He seems always to have been in the special confidence of nature herself. His career already has made an indelible impression on the history of applied science, and I hope that he has many years yet before him in which to make his record still more remarkable."

ARTHUR WILLIAMS HEADS NEW YORK JOVIAN LEAGUE.

Election of Officers and Plans for Coming Year Important Items of February Meeting.

New officers and chairmen of various committees for the year 1917 were elected at the monthly meeting of the Jovian League of New York City, held on February 7. About 150 were present at the meeting and following the election, through the courtesy of the American Telephone & Telegraph Company, an interesting motion-picture entitled, "Speeding the Spoken Word" was shown. This picture vividly portrays the construction and operation of the great Bell telephone system.

It is the intention of the new officers to make the Jovian League of New York one of the "live wire" leagues of the country. Meetings will be held every month in the downtown section. It was also decided to hold meetings of the officials and committeemen on the third Friday of each month, so that the workings of the League may be carried on as energetically as possible.

The new officers elected are as follows:

President, Arthur Williams, New York Edison Company.

Vice-president, J. M. Wakeman, Society for Electrical Development.

Vice-president, Frank E. Watts, Hart Manufacturing Company.

Secretary, H. E. Cleland, McGraw Publishing Company.

Assistant secretary, J. Lloyd Prince, New York Edison Company.

Treasurer, A. S. DeVeau, DeVeau Telephone Company.

Directors, James R. Pollock, Fred Hartman, George Williams, F. H. Leggett, James H. Betts and J. G. Livingston.

ADVANCES IN CENTRAL-STATION OPERATION IN 1916.

Annual Report of Kings County Electric Light & Power Company Shows Many Increases During Year.

In the report of N. F. Brady, president, and W. F. Wells, secretary to the Board of the Kings County Electric Light & Power Company, which includes the Edison Electric Illuminating Company of Brooklyn, N. Y., it is shown that many small users have been connected to the system. This includes over 1,000 unwired houses equipped under the company's partial-payment plan. Very satisfactory results have been attained in securing big power business, the contracts signed aggregating upwards of 50,000 horsepower, including 18 installations of over 3,000 horsepower each. It is also gratifying to note that a three-year contract for 4,600 horsepower has been taken covering the construction of the 14th Street tunnels under the East River. The summary of business obtained during the year as compared with 1915, and the total number of customers is as follows:

	1916	1915	Increase
Total contracts signed	39,989	32,581	7,408
Number of customers, Dec. 31	72,843	58,172	14,671

The resultant increase in current output was as follows:

Kilowatt-hours sold	187,310,588	143,997,941	43,312,647
Largest daily output in kilowatt-hours generated	909,000	805,100	103,900
Maximum load in kilowatts generated	67,500	62,000	5,500

The principal addition to plant was the installation at the Gold-Street station of a 30,000-kilowatt turbogenerator with condensing and auxiliary apparatus replacing a 6,000-kilowatt unit. This machine, which is much more efficient than the one replaced, is being installed in the same space as the smaller unit, thus giving greatly increased capacity at a minimum cost of installation per kilowatt. To furnish the steam required, eight water-tube boilers equipped with stokers and forced-draft apparatus, were placed in the recently completed addition to the South Boiler House. Structural additions to the Station were required to provide space for the electrical apparatus necessary to handle the output of the unit, including switches, buses and 20 high-tension cables.

To insure an adequate coal supply, take advantage of low prices during the summer, avoid shipping delays often encountered in obtaining coal during the winter and eliminate possible embargo on coal consignments by the railroad companies, some 37 acres of water-front property were purchased near Rossville, Staten Island, which will be utilized for the storage of a reserve supply of coal. The company has under way the construction of a concrete bulkhead wall along this entire waterfront, and is installing a large capacity overhead traveling crane which will be utilized in handling coal when received from the mines and in reloading into boats for shipment to the generating stations.

Current-transforming apparatus totaling 10,500 kilowatts has been installed in the substations together with auxiliary units and switchboard apparatus for the control of this machinery. The transmission and distribution systems have been extended to supply the additional customers, approximately 88 miles of feeders and main having been installed, nearly 58 miles of which were placed underground.

During the year the engineers of the company have co-

operated with the engineers of the city in improving the system of street lighting. Fourteen hundred high efficiency Mazda incandescent lamps, ranging in size from 100 to 750 watts, have been installed, and Mazda lamps have now entirely supplanted arc lamps for city street lighting. It is expected that the changes effected will lead to a considerable future increase in this class of business.

On December 22, 1916, the company's rate case before the Public Service Commission was closed. The Commission's order fixes the maximum price for electric service, exclusive of the installation and renewals of electric lamps, at 8 cents per kilowatt-hour. The revised rates took effect January 1, 1917. An idea of the earnings of this company may be had by referring to the financial columns of this issue.

UNFAIR TO REQUIRE UTILITIES TO ANNOUNCE EXTENSION PLANS IN ADVANCE.

Massachusetts Companies Claim Proposed Bill Would Work Hardship.

Bills recommended by the Massachusetts Gas and Electric Light Commission for enactment by the present legislature were heard in committee January 31. Chairman Alonzo R. Weed appeared in advocacy of the measures, which were outlined as the Board's recommendations in a recent issue.

On the proposed bill to require transmission companies to go before the Commissioners with detailed plans, in order that the Board might determine as to the public convenience and necessity of proposed lines, Henry I. Harriman, president of the New England Power Company, objected that such a course would subject an electric company to "holdups" by land owners along the line. He felt that a general description of the route would be sufficient data for the Board to consider. W. R. Peabody, counsel for the Turners' Falls Power & Electric Company and the New England Power Company, submitted amendments embodying Mr. Harriman's suggestion, and it was arranged that a conference would be held before leaving them with the legislative committee.

SUCCESS OF SYNDICATE OPERATION SHOW BY MIDDLE WEST UTILITIES.

Company Makes Rapid Expansion and Its Increased Earning Permit of Dividend on Common Stock in Short Time.

Organized on May 15, 1912, by Samuel Insull, president of the Commonwealth Edison Company and his associates, the Middle West Utilities Company has been notably successful in demonstrating the correctness of the community-group plan of public-utility operation. At the time of its organization the company acquired certain subsidiaries in Illinois, Indiana, Kentucky, Missouri, and some of the New England states. Since then it has added subsidiaries in Michigan, Nebraska, Oklahoma, Virginia and Wisconsin, so that its subsidiary companies are now engaged in the utility business in 14 states.

The subsidiary companies operate, with few exceptions, in cities and towns of comparatively small size. In general they each serve one or more groups of communities, contiguous to each other, from a transmission system fed from one or more economical generating stations, thereby affecting important economies and giving to the smaller communities the same class of service as that given to the cities.

The principal subsidiary operating companies of the Middle West Utilities Company are, in Illinois, the Central Illinois Public Service Company, the Illinois Northern Utilities Company and the Central Illinois Utilities Company; in Indiana, the Interstate Public Service Company and the Southern Indiana Power Company; in Kentucky, the Kentucky Utilities Company; in Michigan, the Marquette County Gas & Electric Company and the Constantine Hydraulic Company; in Missouri, the Missouri Gas & Electric Service Company; in Nebraska, the Central Power Company; in Oklahoma, the Public Service Company of Oklahoma and the Chickasha Gas & Electric Company; in New England, the Twin States Gas & Electric Company; in Virginia, the Electric Transmission Company of Virginia, and in Wisconsin, the Southern Wisconsin Electric Company.

In 1912 the subsidiary companies served 140 communities; in 1916 they served 368 communities with an estimated population of 957,800 and they had 124,158 electric customers and 39,079 gas customers. In addition, in some of the communities they furnish heating, ice, railway and water utilities.

The Middle West Company has, from its organization, paid dividends on its preferred stock at the rate of six per cent per annum and on April 2, 1917, the company will begin to pay dividends on the common stock at the rate of two per cent per annum in cash and two per cent per annum in common stock. That the common stock has been placed on a dividend-paying basis in less than five years from the date of the organization of the company is a source of gratification to those interested in this organization.

ACTIVITY IN ELECTRIC-VEHICLE SALES IN KANSAS CITY.

Electrics Now Used in Many of the Smaller Missouri Towns.

The opening of the annual show of the Kansas City (Mo.) Motor Car Dealers' Association February 12, demonstrated the awakening interest in electric vehicles in the Kansas City territory. One of the first sales of the day was an electric, to a Springfield, Mo., visitor to the show. The dealers in electrics and the branch managers, believe that the next two or three years will show an appreciable gain in the distribution of electrics, even compared with the 250-per-cent gain made by the Kansas City branches the past year. The fever for good roads, as well as the availability of energy for charging, are the two features that will aid the sales. Where two or three years ago, electrics were found only in the largest cities, they are now comparatively common sights in such places as Concordia, Wichita, Junction City, Arkansas City, Ft. Scott, in Kansas, and Carthage, Columbia, Monroe City and similar Missouri towns. The expansion in the use of electrics, both for pleasure and business, is purely a question of pavements.

The motor show has the usual array of exhibits by manufacturers and dealers in electrical equipment.

FLAT AND ROUND PRONGS ON FLATIRONS.

R. S. Hale Outlines Position of N. E. L. A. Wiring Committee.

"The report of the recent meeting of the Wiring Committee of the National Electric Light Association," says R. S. Hale, chairman, "has been misinterpreted so as to give the idea that the Wiring Committee has taken a definite position on the question of flat vs. round prongs on flatirons.

"This is not the case. The Wiring Committee has attempted to arrange a conference of the manufacturers. If that conference should recommend either flat or round prongs, the Wiring Committee would welcome such action as a step towards standardization.

"If the conference should divide between flat and round prongs, then probably the best thing would be not to attempt to standardize until experience has shown which is best.

"The Wiring Committee endeavors to accomplish standardization by getting the manufacturers to agree, and until they agree the report of the Wiring Committee should not be regarded as in any way endorsing any one design as compared with any other."

PRIZES TO HELP MAKE BETTER FAN MERCHANTS.

Western Electric Company's Contest to Stimulate Dealers to Greater Effort.

Generally speaking, no great effort is made by dealers to sell fans to the consumer. The usual method is to put a few fans around the store, show room or in the window. Then, when a real hot day comes the fans sell themselves.

With more effort on the part of dealers, a proper appreciation of merchandising principles and the judicious use of advertising sales helps, the number of fans sold each season could be tripled.

The time to begin selling fans is the first warm day in May. Reminding people of the comforts of an electric fan early in the season will result in their buying fans in May and June, instead of continually putting it off, and then finally going through the summer without buying a fan at all.

To help the dealer reach prospects and stir up an early interest in fans, the Western Electric Company offers an elaborate and complete set of sales helps for the use of its dealers. And to further encourage dealers to put some real selling efforts behind electric fans during the 1917 season, prizes are offered for the best all-around fan campaigns. The following factors will be the basis upon which the prizes will be awarded: (1) Window display. (2) Methods used in house-to-house canvassing. (3) Personal sales arguments used. (4) The use of printed advertising matter. (5) Local newspaper advertising. (6) Lantern slides in local motion picture theaters. (7) Increase in 1917 fan business over 1916. (8) The general campaign as a whole.

The board of judges will be composed of representatives of various electrical trade papers and the Society of Electrical Development.

One dollar will be paid for all photographs entered in the contest.

An information entry blank, which will materially assist dealers in entering the information necessary to judge the merits of their campaign, will be forwarded free to any dealer upon request.

The prizes are: For the best fan campaign, $100; for the next best, $50, and five $10 prizes.

The contest and conditions have been passed upon by the Postoffice Department.

It is anticipated that an unusual amount of dealer interest in selling fans will result this year. The times are propitious; the Western Electric Sales Helps are better and more comprehensive than ever, and there is the added incentive of prizes for the best merchandising fan campaigns.

EXPANSION PROPOSED FOR HOLYOKE (MASS.) MUNICIPAL PLANT.

Annual Report of Manager Shows That Present Equipment Is Inadequate and Must Be Increased to Serve Needs of City.

The construction of a new electric lighting station by the City of Holyoke, Mass., to replace the present station, is advocated in the annual report of the manager of the city's gas and electric department, John J. Kirkpatrick. It is proposed to locate the new station somewhere on the river front, where water will be available at all times for condensing purposes. The present station is on what is known as the second-level canal, and water is often lacking for condensation. The station is in part hydraulically operated at certain seasons of the year, but this feature is not regarded as an advantage in view of the uncertainty of the water supply.

A pressing need is for added coal-storage facilities. At present much of the coal supply has to be hauled from ground storage, at a cost of 50 cents a ton.

The plant's business is increasing so rapidly that new boilers will be required in a short time. Also, it will be necessary to install a new turbogenerator in place of an inefficient unit that has seen long service.

If an entirely new station is not constructed, pressing requirements for coal storage, boiler and turbine changes, etc., will involve an outlay of about $100,000. The present water wheels, installed 25 years ago, obtain only 62 per cent of the efficiency of the water. Their renewal would result in an annual saving of $5,500, Mr. Kirkpatrick reports.

The amount of electricity generated in 1916 was 18,757,000 kilowatt-hours, an increase of 27.6 per cent over 1915. The receipts amount to $385,936, an increase of 13.8 per cent. The plant, it is stated, yielded the city a profit of $100,000 for the year. It pays no taxes, but in lieu of this item, furnishes lighting for all city buildings and for the streets at cost, or two cents per kilowatt-hour. In 1902, the last year the plant was operated by a private company, the city paid $28,347 for street lighting, 263 lamps being in use. In 1916, the city paid to the department $31,230 for street lighting, 1,002 lamps being installed. The domestic rate is six cents net.

BILL TO CREATE PUBLIC SERVICE COMMISSION IN TEXAS.

Measure Introduced in State Legislature Providing for Board of Five Members.

A bill has been introduced in the Texas Legislature by Senator O. S. Lattimore, of Fort Worth, providing for the creating of a state Public Utilities Commission. The measure embraces within its scope practically all kinds of concerns that are engaged in supplying the wants of the public in the matter of utility service. It provides for the creation of a board of five members at an annual salary of $6,000; a secretary at an annual salary of $3,000. The board is empowered to employ such other officers, accountants, engineers, experts, inspectors, clerks and employees as it deems necessary, and to fix their salaries.

The commission shall have control of all public utilities, including telegraph, telephone, heat, light and power companies, water for irrigation or other purposes, street car service, toll bridges, pipe line or other transportation of freight and passengers, except railroad companies now under the control of the Railroad Commission, including plant, equipment and property of such corporations. It also includes any utilities belonging to any municipality, to the extent that appeal can be made to the board by citizens when in their opinion the municipally owned utility is not being operated in a reasonable manner.

The charges made by all utilities for public service shall be arranged by the board. All issues of stocks and bonds of public utilities shall be under supervision of the board.

The board is given the right to make a valuation of all utilities in the state, provide for examination and audit of all accounts and records.

FRANKLIN INSTITUTE HONORS PROMINENT PHYSICIST.

Elliott Cresson Medal Awarded E. F. Northrup for Electric Furnace Research.

The Franklin Institute has recently awarded its Elliott Cresson gold medal to Edwin Fitch Northrup, research physicist, of Princeton, N. J.

This award was made in recognition of a special type of electric furnace developed by Dr. Northrup, in which a temperature of more than 3,000 degrees centigrade can be developed, and of his pyrometric methods and new pyrometric apparatus for the direct and accurate reading of high temperatures up to 1,600 or 1,700 degrees centigrade. Means are provided whereby, with a slight modification in the pyrometric apparatus, rapid measurements can be made of the resistivities of many molten metals and other liquid materials through a wide range of temperature.

LARGE HYDROELECTRIC DEVELOPMENT IN MASSACHUSETTS.

New Station of Turners Falls Power & Electric Company Completed—Ultimate Development of 50,000 Horsepower Planned.

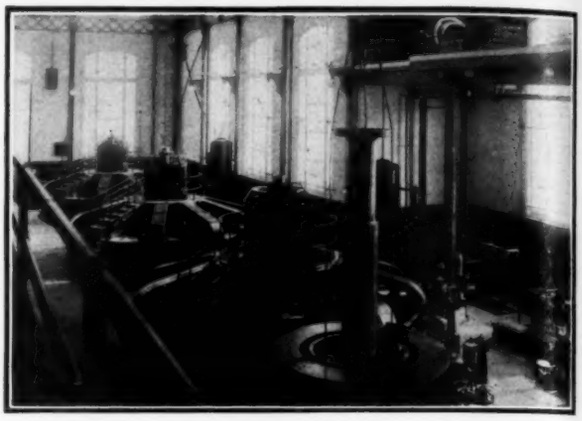
The recent completion of the first unit of an extensive water-power station by the Turners Falls Power & Electric Company, Turners Falls, Mass., marks an important step in the hydroelectric development of New England rivers. The company is an outgrowth of the Turners Falls Company, which was incorporated in 1792 to operate locks and canals, and was reorganized as a water-power company in 1866. With it was consolidated, in 1915, the Amherst Power Company, organized in 1907 to construct a transmission line from Turners Falls south through the Connecticut River valley.

With its allied companies, the Greenfield Electric Light & Power Company, which operates a hydroelectric station on the Deerfield River and a steam station at Greenfield, and the Easthampton Gas Company, which operates a 5,000-kilowatt steam station at Mt. Tom, the system supplies 25 towns by means of a transmission system about 100 miles in length.

The ultimate development at Turners Falls is 50,000 horsepower. Heretofore a hydroelectric station near the town has been operated with water from one of the canals and in 1912-15 the canal was extended several thousand feet, a lake for impounding the flow formed, and a fine station erected at Montague City. Thus far four 7,500-kilovolt-ampere units have been installed in this plant. The water wheels and governors are of I. P. Morris Company manufacture. The wheels have a rated capacity of 10,500 horsepower each, operating on a 58-foot head. The generators are 6,600-volt, three-phase, 60-cycle machines, this voltage winding being selected rather than 13,000-volt units because of lower cost per kilowatt of installation.

There are two sets of transformers, all water cooled, with water piped from the canal, and discharge into the tailrace. There are two banks of transformers, one of 3,500-kilovolt-ampere rating each, for increasing potential from 6,600 to 66,000 volts for main-line transmission; the other bank of 1,500 kilovolt-ampere, 6,600/13,000-volt transformers. The 66,000-volt line extends south to West Springfield and is carried on steel towers. A tie line with Greenfield is of underground construction.

The switchboard at the Turners Falls station is equipped entirely with electrically controlled apparatus. Excitation for the generators is by means of four 100-kilowatt machines, each mounted on a generator shaft, which is equipped with Kingsbury thrust bearings.



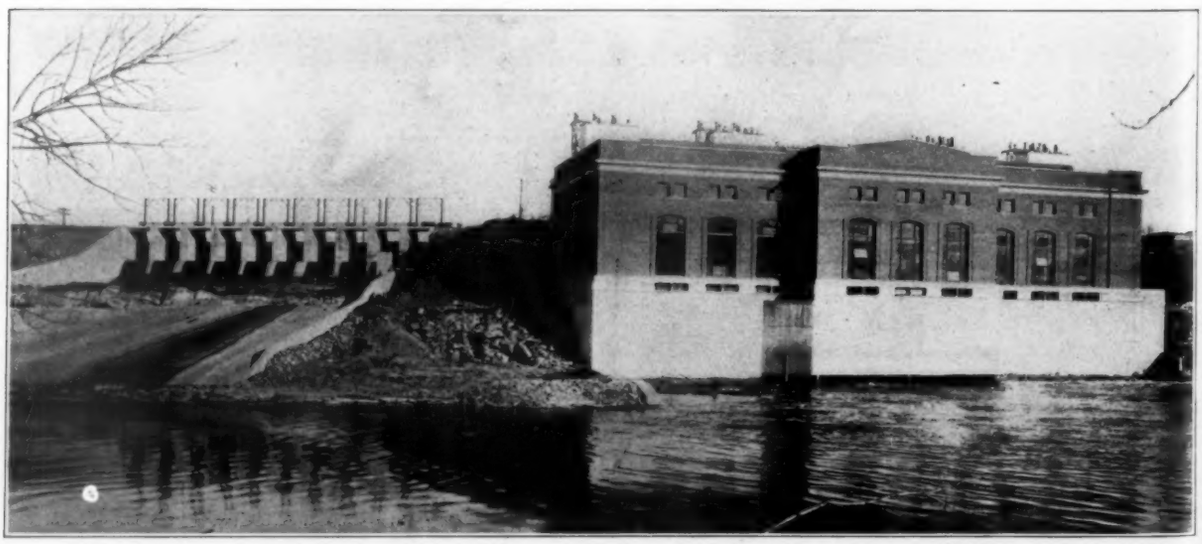
Interior of Plant Showing Turbine in Course of Erection.

A gravity oil system furnishes lubrication for all the machines. After the oil has passed through the machines it is collected in a tank, where it is filtered, and is pumped thence to a supply tank for return to the system, an automatic float switch being connected to the pumping motors. Arresters are located on the roof of the station.

A 60-ton crane serves the whole station floor, and a Gantry crane is installed at the headgates to raise the gates and also to operate a rack rake which removes debris from the roofs. The construction was carried out by the company's own organization.

Proposed Consolidation of Maine Central-Station Companies.

A bill is before the Maine legislature authorizing the Central Maine Power Company to purchase the Bath & Brunswick Light & Power Company, the Penobscot Bay Electric Company, the Waldoboro Water & Electric Light Company, the Hartland Electric Light & Power Company, the Union Light & Power Company, the Newport Light & Power Company and the Wiscasset Electric Light Company. The acquisition of these plants by the Central Maine Power Company is made subject to the approval of the Public Utilities Commission.



New Concrete and Brick Hydroelectric Plant of the Turners Fall Light & Power Company.

Miscellaneous NEWS NOTES

Detroit Edison Company Faced with Coal Shortage.—Alex. Dow, president of the Detroit Edison Company, has issued a public statement calling attention to the shortage of coal in Detroit and the necessity for economizing in the use of electricity until such time as conditions are improved.

Street Lighting Specifications.—A joint meeting of the Pittsburgh Section of the American Institute of Electrical Engineers and the Pittsburgh Section of the Illuminating Engineering Society was held in Pittsburgh, Pa., on February 13, at which a paper by W. E. Reed, consulting engineer, was presented entitled, "Street Lighting Specifications." The meeting was preceded by an informal dinner.

New Electrical Furnaces at Steel Plant.—The Carpenter Steel Company, Reading, Pa., has placed in operation a new electrical furnace, erected as an experiment. The furnace is of steel and concrete, of six-ton capacity, and in operation effects a first heat run off in about six hours. The plant has proved so successful that the company is planning to equip all of its mills with electrical furnaces of the same type, replacing the crucible and other refining furnaces.

Convention of American Association of Engineers.—The midwinter convention of the American Association of Engineers was held at the Hotel LaSalle, Chicago, on February 8 to 10. The principal sessions were held on Thursday morning and on Saturday morning and afternoon. The convention closed with a banquet on Saturday evening, at which addresses were made by a number of prominent speakers, including Walter L. Fisher, former secretary of the interior, who spoke on "The League to Enforce Peace."

Municipality to Wire Houses.—The Common Council of Butler, N. J., is arranging for the inauguration of a plan to wire houses for customers of the municipal electric-lighting plant. The borough is to pay the cost of installation and bill the consumer in monthly payments over a 10-month term for the amount defrayed. By this plan it is aimed to obtain a substantial increase in the number of subscribers of the municipal service, it also being maintained that even with funds available for immediate payment of house wiring consumers prefer defraying the cost in installments.

New York Electrical Society Meeting.—By courtesy of the International Exposition Company, the 353rd meeting of the New York Electrical Society was held at the Pan-American Aeronautic Exposition, at the Grand Central Palace, New York, on February 14. Before an inspection of the exhibits—the most remarkable aeronautic collection ever seen in this country—a brief address was given by Augustus Post, of the Aero Club of America, explaining the features of some of the leading types of flying machines, and at the same time illustrating his remarks by means of motion pictures.

Discussion of Chemical and Electrical Porcelain.—A joint meeting of the American Electrochemical Society, the American Chemical Society and the Society of Chemical Industry was held in New York City on February 9. The subject of discussion was chemical and electrical porcelain, the speakers being L. E. Barringer, Schenectady, N. Y., and Charles F. Binns, Alfred, N. Y. It was shown that the development of the manufacture of porcelain in the United States since the war has been very rapid. Before the war we imported all of our better grades of porcelain and ceramics, but are now making products which compare very favorably with the products formerly imported. It naturally takes time, experience, and a large amount of investigation to develop any high-class product. The manufacturers of porcelain in this country have spent large sums in equipping their plants, and in establishing laboratories for research. Samples of some recent products were shown at this meeting.

Over 100 Enroll in N. E. L. A. Educational Course at Toledo.—An educational course open to any one of the employees of the Toledo Railways & Light Company of Toledo, O., has been formed recently and after one meeting has enrolled more than 100 members.

New 8,000-Kilovolt-Ampere Power Units.—The company located at Utica, N. Y., operates several power stations of varying capacity. Recently it was decided to install two additional 8,000-kilovolt-ampere water-wheel units in one of the stations, marking the biggest hydroelectric developments on this system. As the plant in question is to be tied in with another smaller generating plant a short distance away a generating and transmission voltage of 13,200 volts has been decided upon. Power will be generated by two 8,000-kilovolt-ampere, 60-cycle, 13,200-volt, vertical generators with direct-connected exciters. The order has been placed with the Westinghouse Electric & Manufacturing Company.

Electrical Lift Bridge Saves Haulage.—At its freight station in Los Angeles, Cal., the Santa Fe Railroad is using an electrically operated lift bridge. There are two freight sheds, one for incoming and the other for outgoing freight, each being about 1,000 feet long. When formerly it was necessary to transfer freight from the incoming to the outgoing shed, the freight had to be trucked to the end of the sheds and then across to the opposite shed. Now, however, it is simply necessary to truck the freight to one of the two lift bridges which span the tracks, the bridges being spaced at equal intervals. The bridges are like platforms hinged at one end. A cable is fastened to the end of the bridge which is not hinged and to raise the bridge the cable is wound into a drum which is made to revolve by means of a 7.5-horsepower motor.

Annual Banquet Lynn Section A. I. E. E.—The banquet held by the Lynn Section, American Institute of Electrical Engineers, February 3, was attended by over 300 members and friends, and proved the most successful affair of the kind ever held by the section. Fred M. Kimball was toastmaster, and introduced Hon. Robert Luce, former lieutenant-governor of Massachusetts, as the first speaker. Mr. Luce, who had planned to speak on the "Revision of the State Constitution," said he would not do so, in view of the more vital national problems of the day, and gave a fine talk on the historical aspects of preparedness Other addresses were made by Walter A. Hall, of Lynn; Dr. Ira N. Hollis, of Worcester, and Prof. Elihu Thomson, of Swampscott. Gordon Campbell is chairman of the section, M. B. Carroll, secretary-treasurer, and A. K. Warren chairman of the membership committee.

Electric Club of Chicago Pledges Support to Government.—At the meeting of the Electric Club-Jovian League of Chicago, on February 8, the following resolution was unanimously adopted:

Whereas, The action of the President of the United States, in severing diplomatic relations with Germany vitally affects the welfare of each and every member of this organization, and,

Whereas, We believe that the President should receive the united support of the entire nation in this crisis, therefore, be it

Resolved, By the Electric Club-Jovian League of Chicago, that we pledge our support to the Government of the United States in any emergency that may arise, and that the secretary be hereby instructed to send a copy of this resolution to the President of the United States.

Similar action was taken by the American Association of Engineers in convention in Chicago.

At the Electric Club-Jovian League meeting referred to Horace J. Bridges spoke on "Organic Democracy and Efficiency."

Electricity in Irrigation Pumping

A Discussion of the Salient Features of Electric Irrigation Pumping with Data on the Water Requirements and Power Necessary Together with Operating Results

By NORMAN G. MEADE

Industrial Power Series—Article No. 192

THERE is probably no broader field for electric drive and central-station service than pumping installations. From the small house pump to a large pumping station electric drive has a great many advantages over other forms of power. There is scarcely an industry that does not use pumps for various purposes and public buildings, office buildings, hospitals, apartment buildings, sewage systems, pumping stations for fire protection, irrigation projects and many other applications may be mentioned. Under a great many conditions automatic control of pumps is essential and numerous automatic controllers are on the market that entirely eliminate the attention of operatives. Pumping stations for industrial plants can be located at distances from the works and the pumps started and stopped at will from any convenient place.

The two types of pumps commonly used in connection with motor drive are triplex and centrifugal pumps. The centrifugal pump has the advantage that by the nature of its construction it can handle a wide range of material without injury and foreign substances in the liquid are not as liable to injure this type as the piston pumps. In 1901 it was shown that the centrifugal pump was nothing more or less than a turbine reversed, and when designed on similar lines was capable of handling heads as great, and with efficiencies as good, as could be obtained with turbines themselves. Since this date great progress has been made in both the theory and design, until now it is possible to build a pump for all reasonable conditions of service and to estimate accurately the efficiency and other characteristics to be expected during actual operation.

Mechanical power delivered to the shaft of a centrifugal pump by the motor is transmitted to the water by means of a series of radial vanes mounted together to form a single member, called the impeller, which revolves with the shaft. The water is led to the inner ends of the impeller vanes, which gradually pick it up and with a rapidly accelerating motion cause it to flow rapidly between them so that upon reaching the outer circumference of the impeller, the water, owing to the velocity and pressure acquired, has absorbed all of the power transmitted to the pump shaft. The problem to be solved in impeller design is to obtain the required velocity and pressure with a minimum loss in shock and friction. Since the energy of the water on leaving the pump is required to be mostly in the form of pressure, the next problem is to transform into kinetic energy, the energy water due to its velocity on leaving the impeller and furthermore to accomplish this with the least possible loss.

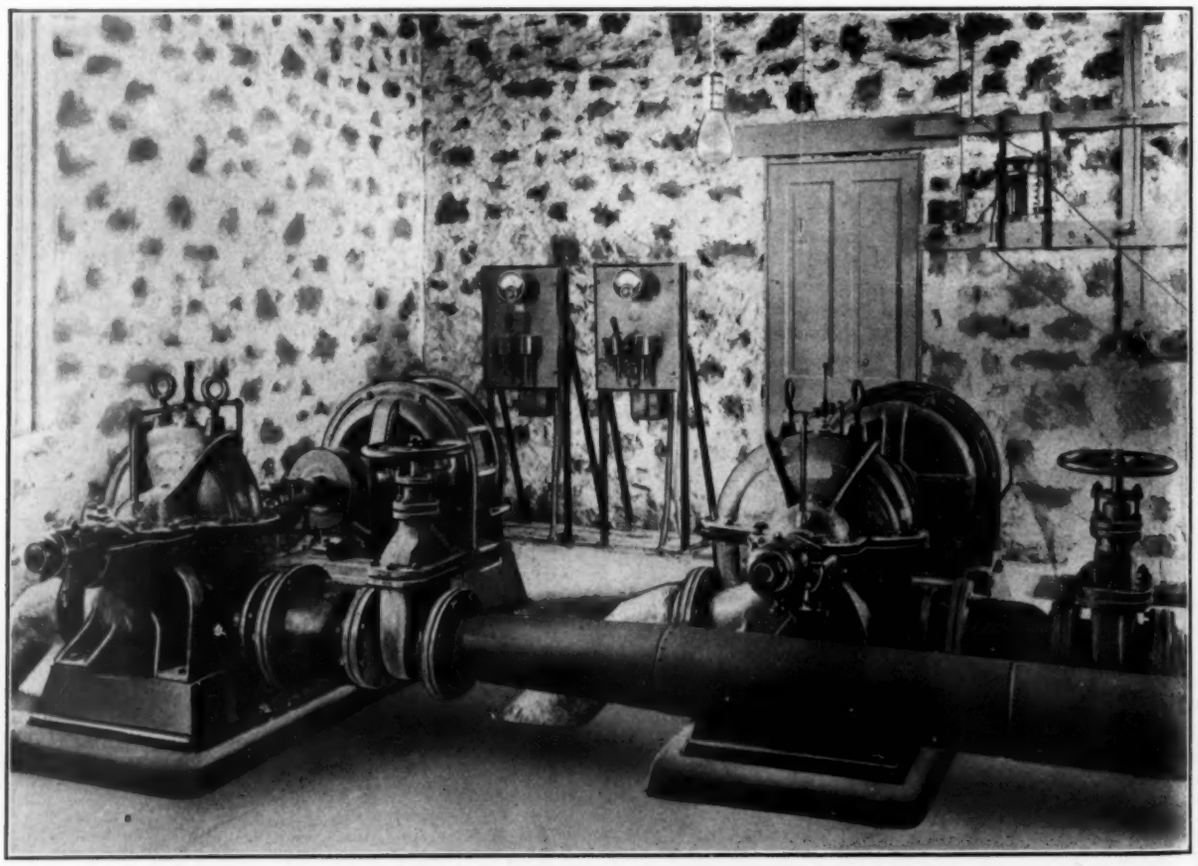


Fig. 1.—View in an Irrigation Pumping Station, Showing Motor-Driven Centrifugal Pumps.

Fig. 2.—Interior of a Modern Small Pumping Plant Employing Motor-Driven Centrifugal Pumps.

Horsepower Required to Raise Water to a Given Height.

There are several formulas that may be used to calculate the horsepower necessary to raise water to different heights in various volumes. For the purpose of the calculations in this article the following formula is used:

$$\text{H.P.} = \frac{\text{Weight} \times \text{height of lift}}{33{,}000}.$$

This formula shows the relation to foot-pounds of work better than the formula in which

$$\text{H.P.} = \frac{\text{Gallons} \times \text{height of lift}}{3{,}958.9}$$

although both formulas will give practically the same result. The first operation is to obtain the weight of water per gallon.

One cubic foot=1,728 inches.

One gallon=231 cubic inches.

Then 1,728÷231=7.48 gallons=one cubic foot.

The weight of one cubic foot of water at 62 degrees Fahrenheit is 62.355 pounds. The weight of one gallon of water is therefore 62.355÷7.48=8.33 pounds.

As an example, assume it is desired to find the horsepower required to raise 1,000 gallons of water a minute to a height of 100 feet, by a triplex pump whose efficiency is assumed to be 80 per cent.

Weight of one gallon of water=8.33 pounds. Weight of 1,000 gallons=8.33×1,000=8,330 pounds. Then

$$\frac{8{,}330 \times 100}{33{,}000} = 25.24 \text{ horsepower.}$$

Dividing this by the efficiency the answer to the problem is

25.24÷0.80=31.55 horsepower.

The chart shown in Fig. 5 is worked out on the above basis for pump capacities up to 1,000 gallons per minute and for lifts up to 100 feet, for triplex pumps with an 80-per-cent efficiency. Fig. 6 is a similar chart worked out for centrifugal pumps with an assumed efficiency of 72 per cent.

Annual Kilowatt-Hour Consumption of Motor-Driven Pumps.

Assume the efficiency of the motors and pumps to be as follows:

Motor efficiency=90 per cent.

Mechanical efficiency of triplex pump=80 per cent.

Mechanical efficiency of centrifugal pump=72 per cent. Combined efficiency of motor and triplex pump will be 90×80÷100=72 per cent.; of motor and centrifugal pump=90×72÷100=64.8 per cent.

Then for a pump of the triplex type, motor driven, the kilowatt-hour consumption per year to raise 1,000 gallons per minute 100 feet is figured as follows:

One kilowatt=1.34 electrical horsepower.

Pump horsepower 1.34×0.72=0.9648.

33,000×0.9648=31,838 foot-pounds per minute.

One gallon weighs 8.33 pounds; 1,000 gallons 8,330 pounds.

$$\frac{8{,}330 \times 100}{31{,}838} = 26.16 \text{ kilowatts.}$$

365 24-hour days per year=8,760 hours, and 26.16×8,760=229,161.6 kilowatt-hours. The kilowatt consumption of centrifugal pumps is figured in the same manner with the exception that the efficiency 0.648 is substituted. The charts, Figs. 17 and 18, have been worked out from these calculations.

Irrigation With Electrically Driven Pumps.

Irrigation is by no means a new or untried science. As practiced today it is utilizing on a large scale the function of the sprinkling can and the garden hose. The rapid strides made in this field during the last few years, however, have led to a widespread interest in the possibilities of intensified agriculture, not only in the so-called arid regions, but also in the semi-humid sections where the crop failures through lack of sufficient rainfall are a serious consideration.

The field for irrigation is almost unlimited, ranging as it does from the reclaiming of arid deserts to forcing the crops of small truck gardens. Included in these limits is the medium-size farm in the semi-humid regions, where the addition of water in the desired quantities at the time most needed will insure early ripening and maximum crops. In the arid countries irrigation is necessary to secure any results. In the humid or semi-humid regions it is the recurrence of periods of small or no rainfall, especially when the crop is at or near the fruiting stage, which seriously impairs the size of the yields. Generally 0.05 to 0.1-inch rainfall when occurring in single precipitations or separated by two or three days from any other rain, benefits farm crops very little.

In experiments conducted in Wisconsin it was found necessary to water crops as often as every week and even this was found to be too long an interval for coarse or sandy soils. In field work it was found advantageous to apply two inches of water to corn, cabbages and potatoes every ten days unless there had been from one-half to one inch of rainfall in the

interval. Starting with the soil well supplied with moisture at seeding time, a uniform supply of rainfall equal to one inch in seven days throughout the growing season, should provide all the water necessary for very large crops. Many parts of the United States east of Central Kansas, Nebraska, and the Dakotas, have this amount of rainfall, but the distribution in time and quantity is such as to cause serious droughts.

Duty of Water.

By the term "duty of water" is meant the amount of water necessary to serve a given amount of land. The unit duty

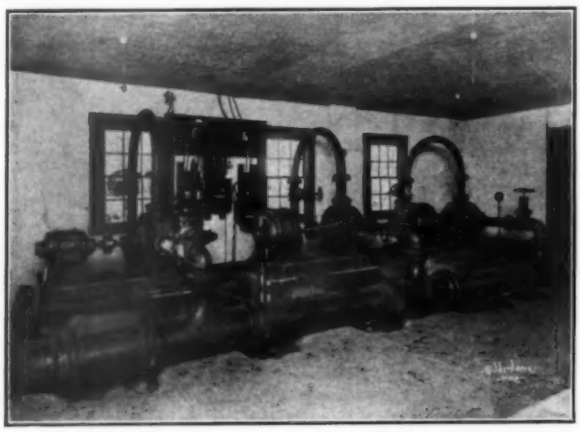


Fig. 3.—Typical Plant Showing Small Space Occupied by Electric Units.

is the acre-foot or the amount of water necessary to cover one acre to a depth of one foot. No exact rule can be laid down for any particular crop since the amount varies with the texture of the soil, sub-surface moisture, temperature, wind velocity and many other varying local conditions. The following table gives the experiments conducted in Wisconsin and may be taken as the average for similar climatic conditions and for medium soils.

TABLE SHOWING HIGHEST PROBABLE DUTY OF WATER FOR DIFFERENT YIELDS PER ACRE OF DIFFERENT CROPS—LEAST NUMBER OF ACRE INCHES OF WATER.

Bushels Per Acre Crop	Wheat	Barley	Oats	Corn	Potatoes
15	4.5	3.21	2.35	2.52	.....
20	6.0	4.28	3.13	3.36	0.41
30	9.0	6.42	5.70	1.04	0.62
30	9.0	6.42	5.70	5.04	0.62
40	12.0	8.56	6.27	6.72	0.83
50	15.0	10.7	7.84	8.4	1.03
60	18.0	12.84	9.40	10.08	1.24
70	.....	14.98	10.98	11.75	1.45
80	.....	.....	12.54	13.43	1.65
100	.....	.....	15.68	16.77	2.07
200	.....	.....	.....	.....	4.14
300	.....	.....	.....	.....	6.2
400	.....	.....	.....	.....	8.27

The duty will naturally be higher for coarse sandy soil or hot dry climates and less for fine or clay soils and a relatively moist climate. The amounts given as the duty of water represents the total of the rainfall and the supplemental amounts applied by irrigation. For any given locality it is only necessary to subtract from the duty of water as given, the rainfall during the season, for the locality, in order to know the amount by which that rainfall must be supplemented to produce these maximum crops.

Irrigation by Pumping.

At the present time the subject of irrigation has been so thoroughly canvassed as to leave but few localities which can be supplied from gravity ditches except at excessive cost. Fortunately, however, the advancement in mechanical methods of supplying water to lands not accessible from gravity has kept pace with the needs of the irrigator so that it has been fully demonstrated that irrigation by pumping is both practical and economical.

The field for irrigation by pumping removes the limits usually surrounding all but the most favored farms since it enables use to be made of any surface or underground waters whether lake, nearby stream, marsh, or well, to be found within a reasonable distance below the surface of the land to be irrigated. Wells may be either of the drilled or dug type.

From the standpoint of first cost for installation as well as for economy of operation, the electric motor offers the ideal motive power. The ever increasing network of electrical transmission will thus generally solve the problems of power. Among the more marked advantages resulting from pumping by electricity with attendant benefits of available electric power for other uses are the following: Water immediately available at all hours of the day and night; complete independence of neighbors' requirements for water; each pumping plant is a complete self-contained unit; minimum cost of installation, operation and repairs; no skilled mechanic required; no attendance necessary except for starting, stopping and occasional oiling; no complicated parts to keep in repair, nor delicate adjustments to be made; no risk from fire or explosion; operating expense ceases when pump stops, allowing advantage to be taken of all natural rainfall; current is available for lighting houses, barns and yard for convenience or for emergencies, making night work feasible, etc.

Cost of Irrigation Pumping.

It is difficult if not impossible to give information as to the cost of irrigating equipment which will be correct for all conditions, owing to the variation of the elements of water supply, lift, length of season, amount of water required for various crops and localities, nature of soils, etc., but the following examples will serve to indicate the cost of installation and operation for typical conditions. The result of tests on about 60 small pumping plants in Colorado from which actual costs were obtainable showed that under

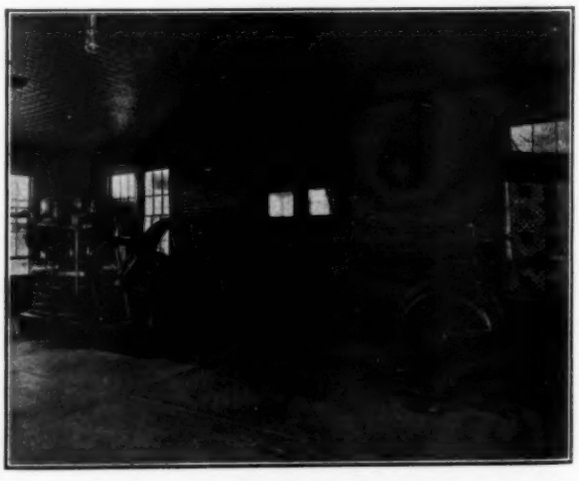


Fig. 4.—75-Horsepower Motor Driving Compressor in Pumping Plant.

average conditions a good efficient plant capable of irrigating 160 acres of land through a lift of 25 feet represented an investment by the farmer of $7.45 per acre.

Operating costs are subject to wide fluctuations depending upon the cost of power and the efficiency of the plant, but from figures obtained by the General Electric Company in connection with the tests in Colorado it was shown that the operating cost varied between $1.75 and $2.25 per acre-foot for 160-acre tracts under 25-foot lift. The following comparison between the cost of irrigation by pumping and by gravity ditches is conclusive:

If the figures given in the Colorado cases are accepted as average costs for 160-acre tracts, pumping from wells

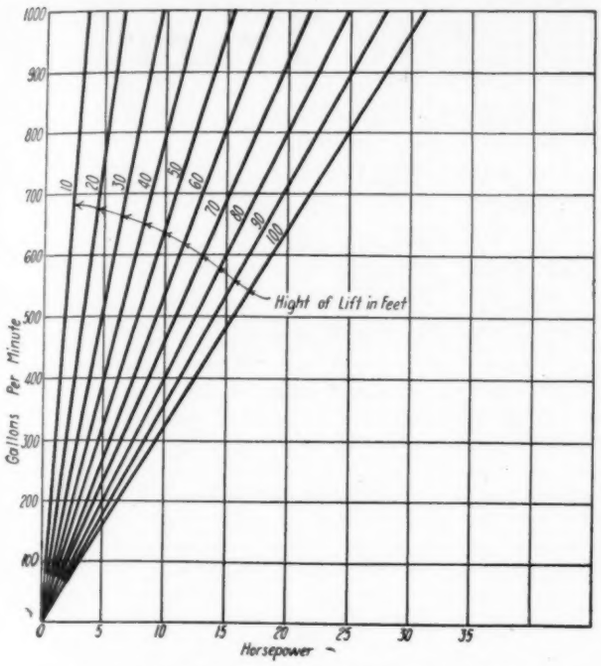


Fig. 5.—Horsepower Required by Triplex Pumps—Efficiency Assumed 80 Per Cent.

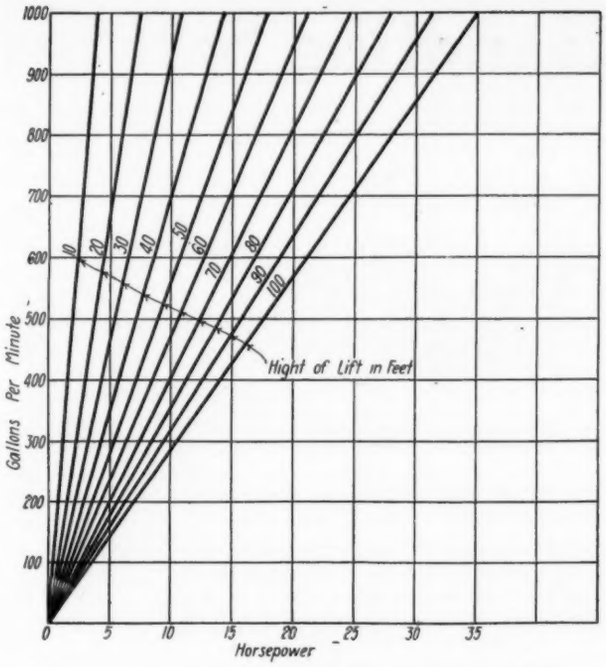


Fig. 6.—Horsepower Required by Centrifugal Pumps—Efficiency Assumed 72 Per Cent.

20 feet in depth and assuming ditch water rights at $50 an acre with $1.25 maintenance charge including depreciation on ditches and flumes, which is very low, there is a considerable saving to the farmer by the use of pumping equipment. Figuring interest at six per cent on the original $50 per acre, investment in ditch rights, plus the maintenance charge of $1.25, the cost to the farmer is $4.25 per acre per year for gravity irrigation. Taking the same interest charge on the original pumping investment of $7.45 with an added depreciation charge of four per cent or 10 per cent total, the cost to the farmer for irrigation by pumping is $0.75 plus $2 average operating cost, or $2.75 per acre per year, or a saving of $1.50 per acre per year, and this without taking into consideration the tremendous advantage of being assured of water at just the time it is required regardless of neighbors' demands.

From data available on large projects the initial cost of pumping for 4,000-acre tracts under 50-foot head is $15 per acre plus $1.85 for power, based on $20 per horsepower per year, and attendance. Figured on the same basis of six-per-cent interest and four-per-cent depreciation or 10-per-cent total on the initial cost per acre, the cost to the farmer is $3.35 per acre per year. In this same district the average cost of ditch water rights is $60 per acre with $1.50 maintenance charge, or a total cost to the farmer of $5.10 per acre per year. It is believed that these figures represent fair average conditions for plants of their respective capacity.

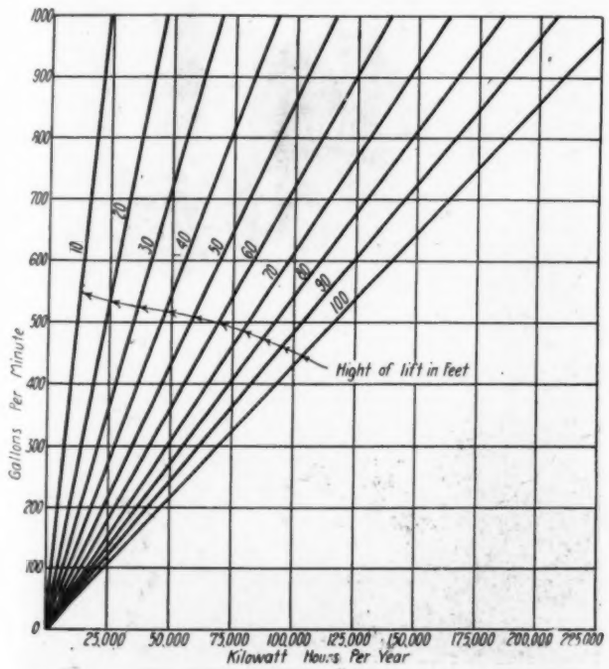


Fig. 7.—Kilowatt-Hour Consumption for Centrifugal Pumps.

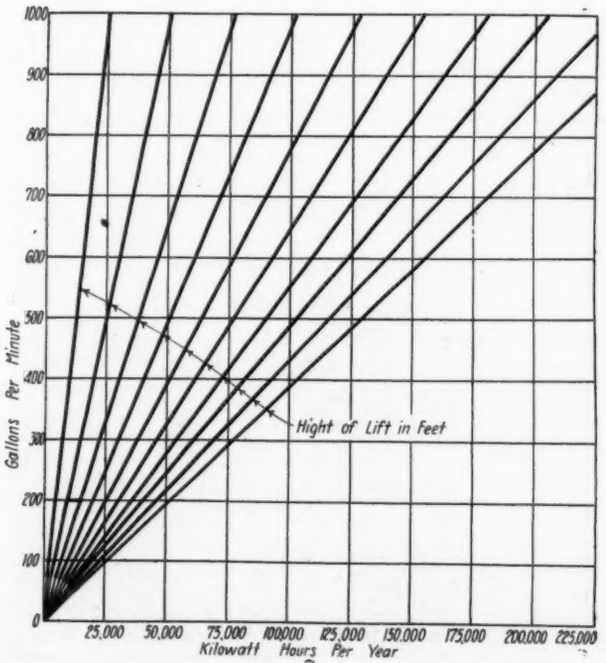


Fig. 8.—Kilowatt-Hour Consumption for Triplex Pumps.

Handling Salt by Electric Tramway

Details of a Unique Bucket-Conveyor System for Transporting Salt a Distance of 13.5 Miles Over a Mountain Range Which Effected Vast Savings in Time

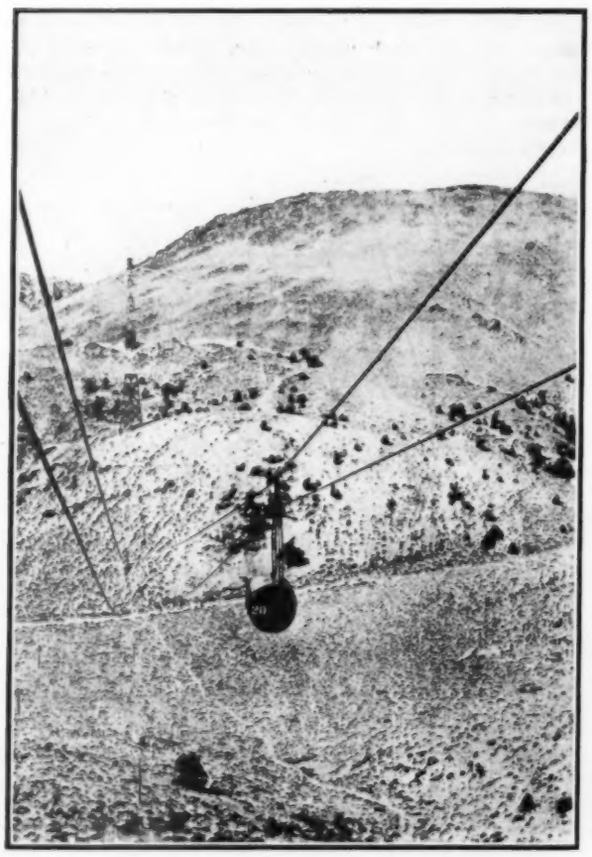
By ALBERT MARPLE

ONE of the most interesting electric tramways ever constructed in the western part of this country has just been completed between Saline Valley and a station called Tramway or Swanson, the distance between these two points being 13.5 miles. Saline Valley is located in Inyo County, Cal., close to the California-Nevada state boundary line. It is about 15 miles east of Owens and 75 miles northeast of Death Valley. It is reached through Lone Pine, the nearest settlement on a main railroad line. From Lone Pine a branch railway is run to Swanson and from that place the valley is entered by passengers and freight via this electric tramway, while vehicles may enter by the long-way-round wagon road.

Since 1868 salt has been carried from Saline Valley. For the first few years it was taken out on the backs of burros, the trip from the valley to the nearest railroad line taking several days. This method eventually became too slow and in 1880 a wagon road, such as it was, was built connecting the valley with Big Pine. This was 60 miles long and 40 miles of this distance was positively "dry," water for both animals and men having to be carried along in tank wagons. That the grades of this road were terrible will be realized when it is learned that to make the trip over that 60 miles took 13 days of hard fighting. The teams consisted of 16 horses or mules and the maximum amount of salt that could be carried each trip was eight tons.

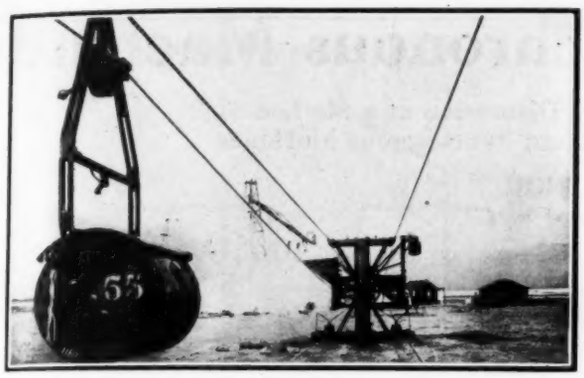
This wagon method of conveying salt from this valley continued until a comparatively short time ago, when the electric tramway was completed. Energy for the operation of the tramway is secured from a high-tension line which runs from Owens River through Swanson to one of the principal cities of southern California. To build this tramway the promoters had to overcome the following difficulties: Saline Valley is located at an elevation of 1,000 feet and the altitude at Swanson is 3,500 feet. Between these two points is located a range of mountains of the most rugged type imaginable, the lowest point on the ridge of which is 8,700 feet, this point being located practically on a straight line between the valley and Swanson, the distance between which two points is 1.5 miles.

The cost of construction was in excess of $1,000,000. It is what is known as a four-wire system. That is, for both the "going" and "coming" buckets there is a carrying and a pulling wire. The carrying or "load" wire consists of a series of relay stationary wires 1.125 and 1.25 inches in diameter and having a breaking strain of 90 tons. Each load wire has one terminus at an "anchor" station and another at a "tension" depot. At the anchor-station end the wire is stationary, while at the tension station, there being one of these every mile and a quarter, the wire is fastened to a heavy weight, the purpose of which is to keep the wire tight at all times, and to take up the "slack."

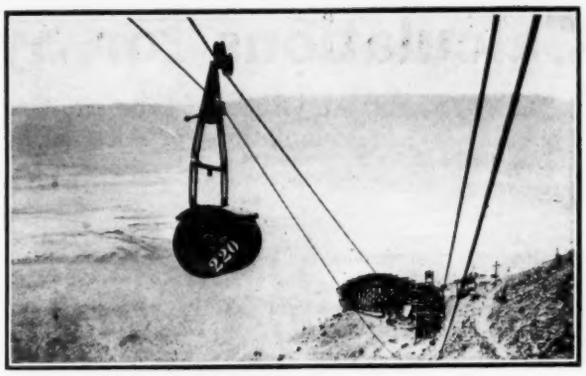


Portion of Tramway Crossing Mountain—Bucket Enroute.

One of the Relay Stations Where Buckets Are Transferred.



A Loaded Bucket Leaving Station.



Bucket Starting Ascent Over Mountain.

The "pulling" wires are also in relays and are endless. Along the route there are five power houses, and between each two of these, excepting the two located side by side at the summit, there is one of these endless pulling wires. These pulling wires are 0.875 of an inch in thickness, and the work of each of these wires is to catch the buckets as they enter the outside station and to pull them along the load wire until the opposite end of the circuit of the pulling wire is reached, whereupon the buckets are released and sent forward to be caught by the next relay pulling wire. Upon releasing the bucket this pulling wire crosses over to the opposite load wire and upon the return trip occupies the same position to that wire that it did to Load Wire No. 1 on the outward trip. On the return trip the pulling wire draws the empty buckets back to the salt fields or Station No. 1.

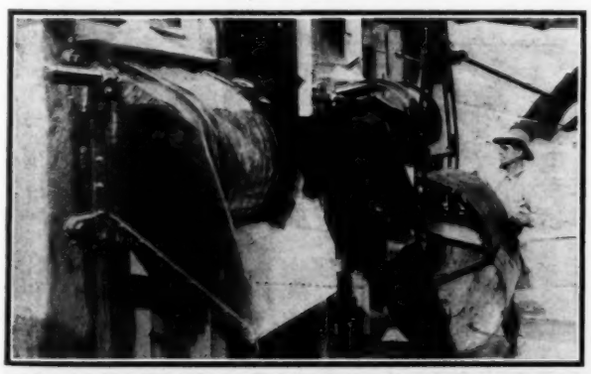
The electric power stations, with the exception of the two at the summit, are practically the same distance apart. Each is equipped with a 75-horsepower electric motor. It takes about 200 horsepower to propell this tram when it is working to capacity—that is, when the line is conveying 20,000 tons of salt an hour. Between these power houses, at points at various distances apart, and where most needed, there are 34 curved-rail, tension and anchor stations, and about 150 timber towers, these ranging in height from 12 to 150 feet. The purpose of a curved rail is to eliminate the greater than six-degree bend upon the load wire at the point where the wire crosses the ridge of a mountain or hill. At these points these curved rails take the place of the load wires.

This tramway works on an average of 20 hours in the day, 11 months of the year. Buckets holding 700 pounds of salt are sent away from the sending station one each minute, and these travel 500 feet per minute until the destination, the Swanson station, is reached. Saline Valley is 1,500 acres in extent, and is solid salt. Tests have been made down 30 feet and nothing but salt has been found. It is claimed that there are at present 90,000,000 tons of salt in sight.

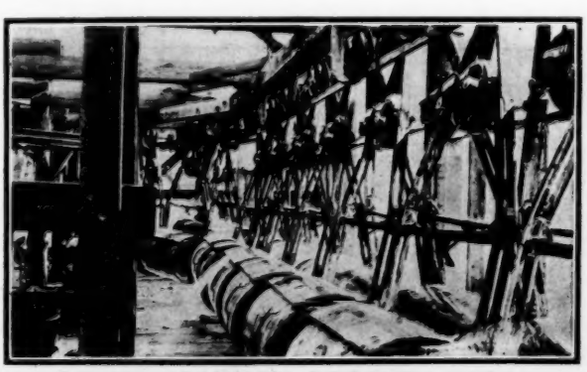
The first step in preparing this salt for gathering is to flood it with pure mountain spring water. This water is pumped to the fields through steel pipes from a 60-inch spring located about a mile and a half from the bed of the valley. The salt for a foot or so upon the surface is dissolved by this water, this permitting the sediment which has collected through the years, to settle out of the way. This saturated solution then sinks down among the lower salt flakes, so that upon these it is possible for the workmen to walk in safety. Within a few days the excessive heat of the sun in the valley evaporates the water in the upper inch or so of salt, leaving this as pure and white as snow, and ready for gathering.

To gather the salt an automobile plow is used. This travels back and forth across the field collecting the upper inch of salt and arranging it into long even rows. Workmen then pile this into round stacks. This salt is later loaded onto trucks holding 1,200 pounds each and conveyed to one of the loading stations on the field. From these stations the salt is taken by rail to Station No. 1 of the tram, and loaded into tram buckets, and started along the cable. After being started the buckets need no attention until the end of the tram at Swanson has been reached. There they are simply emptied and started on the return trip. After leaving the tram bucket at the Swanson end the salt is carried in electrically-propelled conveyors to the mammoth dryers, which, also, are operated by electricity, and when dry is broken by a gradual rolling process by specially devised, electrically operated machinery, after which it is then ready to be poured into cartons and packages.

Where formerly it took 13 days to haul salt out of this valley, by the use of the electrical tramway it is now possible to gather it, send it over the tram, dry and pack it in two hours and 35 minutes.



Method of Filling Buckets at Starting Point.



Filled Buckets at Starting Point Ready for Trip.

Calculations for Synchronous Machines

An Original, True and Practical Discussion of a Method of Calculation for Alternating-Current Synchronous Machines

By THEO. SHOU,
State University of Iowa.

If magnetic flux density per square centimeter=B, then at the position of coil shown in Fig. 2, the amount of flux in maxwells (c.g.s. lines) embraced by the coil is

$$\phi=BL(b-x)-BLx=BL(b-2x).$$

The fundamental equation for induced voltage by Maxwell

$$e=-d\phi/dt$$

but

$$d\phi=-2BLdx$$

therefore

$$e=10^{-8}2BLdx/dt \text{ volts.}$$

Now

$$dx/dt=\text{velocity}=2\pi rn/60$$

whene n=revolutions per minute=cycles$\times$60/p

p=number of pairs of poles.

Therefore

$$dx/dt=2\pi rf/p$$

where

f=cycles per second.

By substituting this value for dx/dt in the voltage formula we have

$$e=10^{-8}2BL\times 2\pi rf/p=10^{-8}4\pi BLrf/p$$

or for a two-pole machine

$$e=10^{-8}4\pi BLrf \text{ volts.}$$

Flux per pole=$Bl\pi r$, and if we have w turns per phase in series we get

$$e=10^{-8}4\phi fw \text{ volts}$$

or

Flux per pole (c.g.s. lines)=$e10^8/4fw$.

This formula does not take into consideration form-factor, f_b, spread-factor, f_w, or chord-factor, f_c,

f_b depends upon shape of pole or field form.

f_w depends upon number of phases and number of slots per pole.

f_c depends upon throw of armature coil.

To compensate for these factors we have

$$\phi=e10^8/4fwf_bf_cf_w.$$

Evidently this effective flux per pole is equal to the total maximum flux times the pole constant, C_p (where C_p depends upon the shape of the pole) divided by the number of poles. (By total maximum flux is meant the maximum flux-density

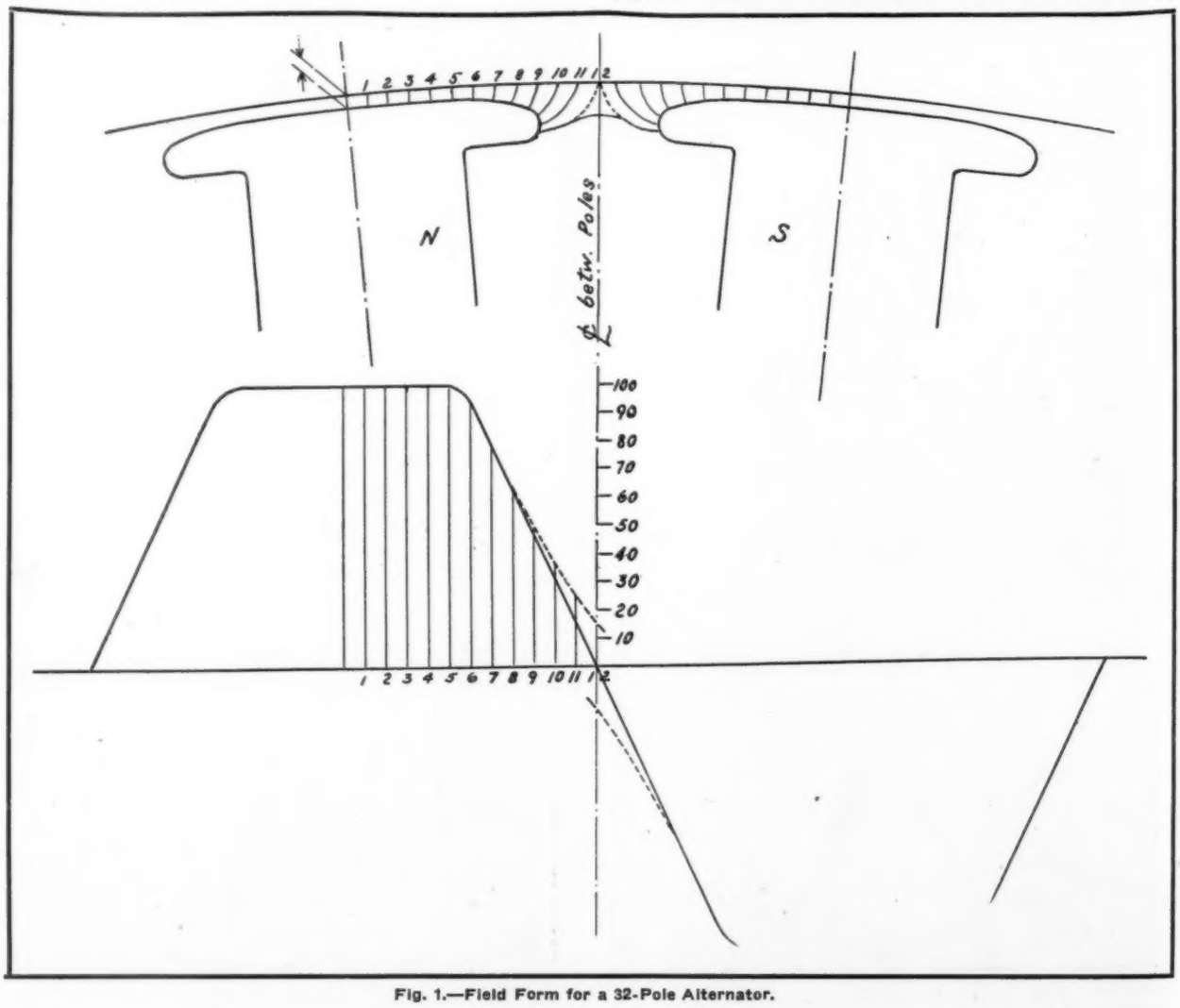


Fig. 1.—Field Form for a 32-Pole Alternator.

under the pole in the air gap times the total surface of the armature in square centimeters.)

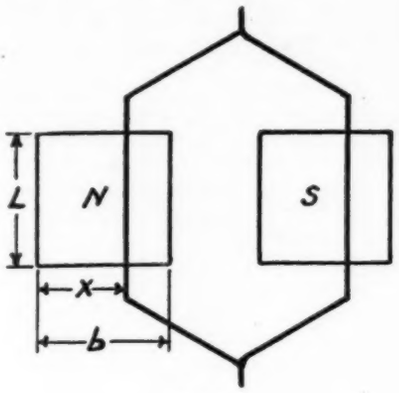


Fig. 2.

We therefore have

Flux per pole, $\phi = \phi(\text{total}) \times C_p/2p = e \times 10^8/4 f_b f_w f_c w f$

Now

$$f = np/60$$

and

$w = \frac{1}{2}N$, where N = effective conductors in series per phase.

Then by substituting

$$\phi(\text{total}) = \frac{10^8 \times 60}{f_b f_w f_c C_p N n}$$

For three-phase star-connected machine

e per phase $= E$ (terminal—terminal)$/\sqrt{3}$

and

N per phase $= N$ (total)$/3$

or

$$\phi(\text{total}) = \frac{E(t\text{—}t) \times 10^8 \times 60\sqrt{3}}{f_b f_w f_c C_p n N \text{ (total)}}$$

To simplify this formula and also introduce inches instead of centimeters, we may calculate in Kapp lines instead of in maxwells. One Kapp line equals 6,000 maxwells, or

$$\phi(\text{total}) \text{ (Kapp lines)} = E \times 10^6 \sqrt{3}/f_b \times f_w \times f_c C_p n N$$

or we may write this formula

$$\phi(\text{total}) = E \times 10^6/C_w f_c n N$$

where C_w is called the winding constant and is a product of three factors: f_b, f_w and C_p times a constant depending upon phase and connection.

E is the effective terminal voltage.

N is the total number of effective conductors.

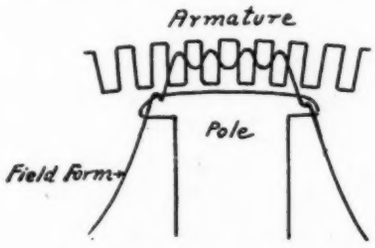


Fig. 3.

This formula is used by several leading manufacturing concerns in the United States.

For three-phase star connection we have

$$C_w = f_b f_w C_p/\sqrt{3}$$

For three-phase delta connection

$$e = E$$

N per phase $= N$ (total)$/3$. Therefore

C_w (three-phase delta) $= f_b f_w C_p/3$

For two-phase, open-type winding

$$e = E$$

N per phase $= 1/2\ N$ (total)

and

C_w (two-phase) $= \frac{1}{2} f_b f_w C_p$.

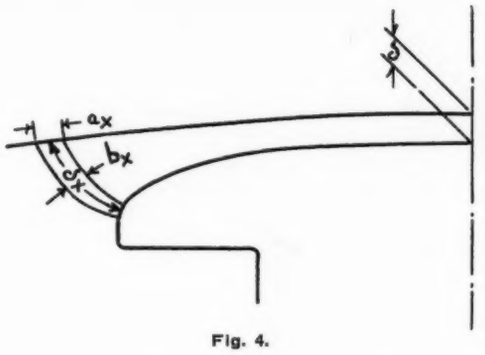


Fig. 4.

Determination of Field Forms.

Distinction should be made between machines with definite poles and those with distributed field winding, the method of calculation being different in each case.

Machine of Definite Pole Construction.

In order to determine the field form, a drawing should be made showing the proposed field layout of two adjacent poles, or one pole pair in relation to the armature; care should be taken that this drawing is correct and to scale. We will assume a smooth-faced armature; that is, we will neglect the effect of the armature slots on the field form. The actual condition could of course be used, showing the armature slots and slots in the pole face (if any) drawn to scale and so by drawing in the different lines of force leaving the pole and joining the armature, we could get for the lines of force a more true reluctance, and such a field form would show the effect of the open armature slots as indicated in Fig. 3.

This method is at the best a tedious affair and experience along this line has shown that for practical purposes little or nothing is gained as far as correctness is concerned. Furthermore, when laying out the field form for a certain machine, the designer has in most cases not determined the final size and arrangement of the armature slots.

We will therefore proceed, using a layout as shown in

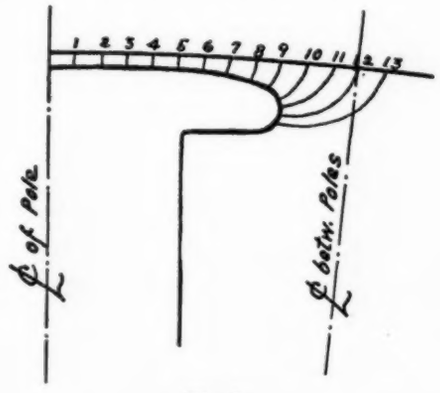


Fig. 5.

Fig. 1. This sketch refers to a 225-revolutions-per-minute, 60-cycle machine or a 32-pole alternator. One pole pair is here drawn to exact scale and the air gap, δ, between the pole center and the armature bore is the actual air gap of the machine. Lines of force are shown drawn from pole faces to armature. By drawing in these flux lines it should be borne in mind that distribution of flux is always such that the magnetic field energy is a maximum, therefore such distribution comes nearest to the reality which has the maximum mag-

netic conductivity. Furthermore it should be understood, that as the permeability of the iron compared to that of the air is very great, the lines of force will leave and enter the iron at approximately 90 degrees to the surface.

Therefore in the air gap under that part of the pole face which has approximately the same air gap as exists under the

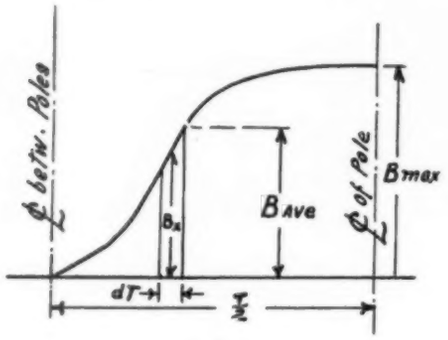


Fig. 7.

center of the pole, the lines of force should be drawn as straight radial lines. In the air gap under the pole tip, however, the lines of force must have a curved form, making an angle of almost 90 degrees with both the armature and the pole surface.

Assuming the magnetic potential between the pole tip and the armature everywhere constant, the field intensity, B, is at any point proportional to the permeance of a tube of air of unit cross-section.

In Fig. 4 a tube of force is drawn from pole tip to armature; δ_x is the length of the axis, b_x is the mean width of the tube. The permeance is therefore proportional to B_x/δ_x.

The maximum flux density under the pole evidently exists where the air gap is a minimum. Obviously the maximum flux density, which we will denote as 100 (or 100 per cent of the maximum flux density) exists along that part of the pole face that has a curvature concentric with the armature bore. If we use the air gap, δ, as a unit for measuring the lengths, δ_x, of the different tubes, we may assume the density at any point x

$$B_x = 100/\delta_x$$

Using this construction the field form as given in Fig. 1 is plotted. By careful measurement it was found, using the air gap ($\delta=1$) as unit,

$\delta_1=1$, $\delta_2=1$, $\delta_3=1$, $\delta_4=1$, $\delta_5=1$, $\delta_6=1.04$, $\delta_7=1.25$, $\delta_8=1.56$, $\delta_9=1.92$, $\delta_{10}=2.7$, $\delta_{11}=4.2$, $\delta_{12}=5.8$,

It is noticed in Fig. 1 that the values of B near the neutral zone or center line between the poles come out too high; this is because a diagram of the actual field, especially near the neutral zone, can hardly, or cannot at all, be drawn, even if the number of lines of force used in this construction were largely increased.

We know, however, that a field curve will always follow a straight line, where it passes through zero; therefore, by joining the two field curves together with a straight line through zero, we are very nearly approaching the actual field form.

Fig. 1 shows the diagram of the field form over one complete cycle (360 electrical degrees). It is obvious, however, that for practical purposes it will do to construct the field curves from 0 to 90 degrees only.

The designer will reduce the layout as in Fig. 1 to a layout as shown in Fig. 5 and plot the field form on any cross-section paper (preferably 20 lines to the inch).

The pole pitch, τ, on the armature surface, is divided into 24 equal parts and the lines of force drawn to—say, the twelfth or thirteenth division. As the fluxes of adjacent poles of opposite polarity are superimposed on each other, the actual field form is obtained by subtracting the field densities of the two poles, where they overlap. (See Fig. 6.)

Since the length, x, for one pole is never equal to infinity, the field intensity will never become zero. Hence, with this construction the actual or resulting field form would never reach the maximum value of 100 under the pole. Considering, however, that the flux of one pole can never penetrate the air gap of the other, we modify our construction as indicated in Fig. 6.

Determination of the Pole Constant.

The pole constant, C_p, is the ratio of the area inclosed by the

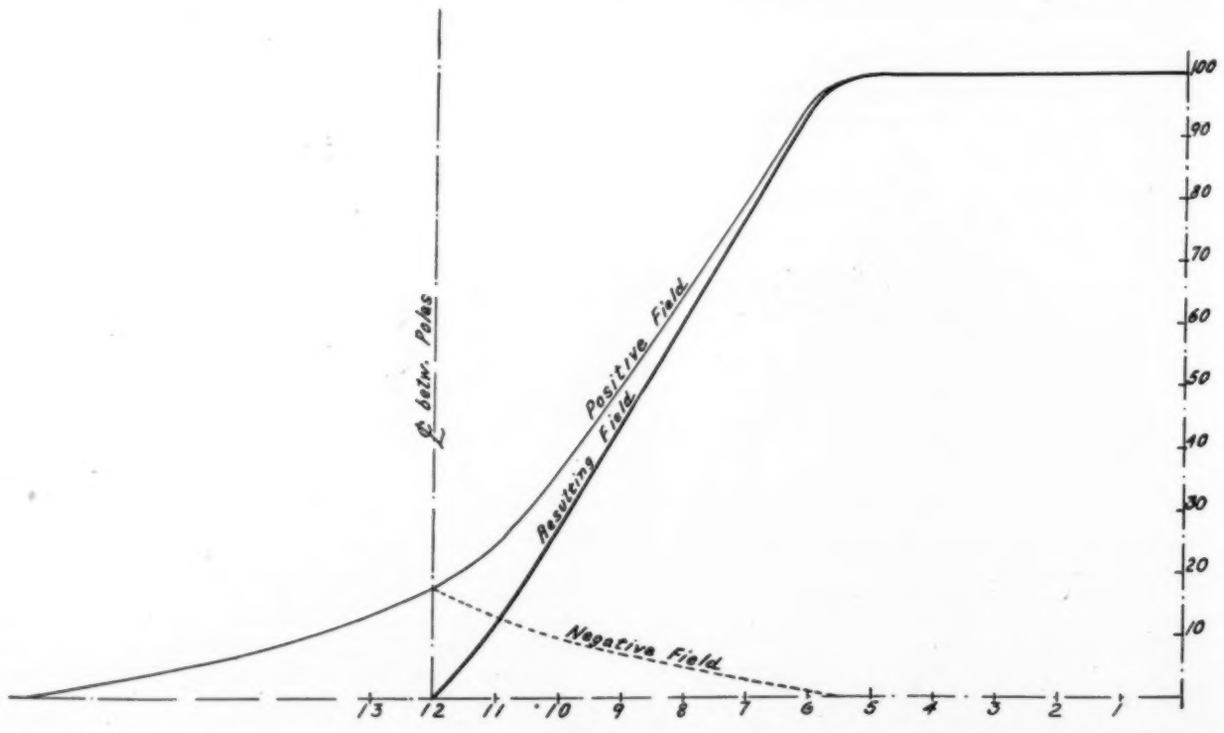


Fig. 6.

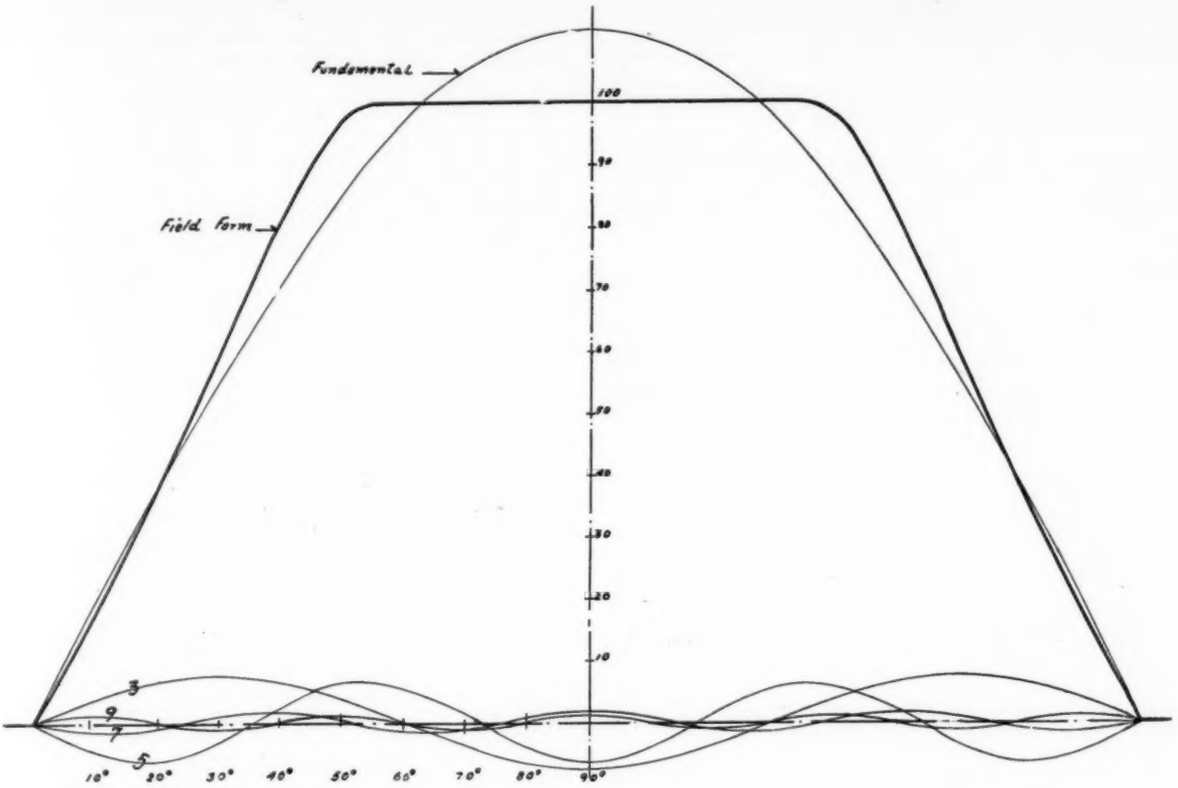


Fig. 8.

actual, plotted, resulting field form to the area of the rectangle having the same maximum value and the same base line.

$$C_p = \frac{\int_0^{T/2} B_x dt}{\frac{T}{2} B_{max}}$$

and since

$$\frac{2}{T}\int_0^{T/2} B_x\, dt = B_{ave}$$

The pole constant can also be defined as the ratio of the average flux density to the maximum.

$$C_p = B_{ave}/B_{max}.$$

As the field curve almost always is an irregular curve, the above equation can not be readily solved. In order to do so the field curve might be resolved into its fundamental and higher harmonics. Field forms ordinarily met with, being symmetrical about the midordinate, make this extremely simple, as all the harmonics of even order are eliminated and all the uneven harmonics are in phase, that is, they all pass through zero at the same time. (See article by Fischer-Hinnen in the *Elecktrotechnische Zeitschrift* of May 9, 1901.)

Fig. 8 shows the field curve as per Fig. 6 resolved into its fundamental and higher harmonics up to and including the ninth. The harmonics above the ninth are not drawn in, as their effect compared to the lower ones is very small. The values (crest) of the fundamental and higher harmonics were found to be:

1	3	5	7	9	11	13
+112.12	+7.84	−6.69	−1.52	+1.26	0	−0.693

15	17	19	21	25	27
+0.066	+0.1175	−0.158	+0.0476	−0.04	+0.037

$$a\int_0^{\pi/2} \sin x\, dx = -a\cos x\Big]_0^{\pi/2} = a$$

where a is the crest value of the sine wave.

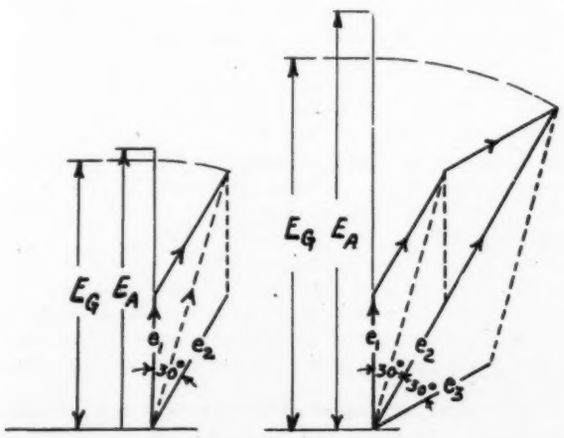


Fig. 9.

Fig. 10.

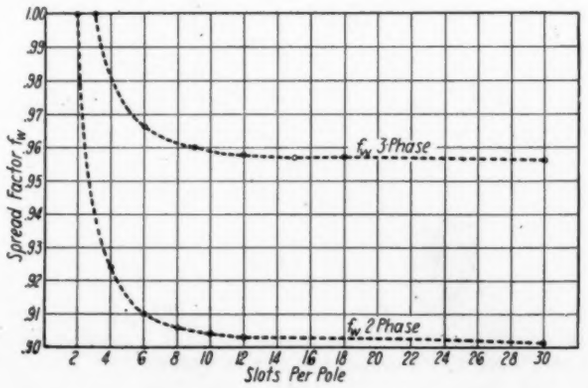


Fig. 11.

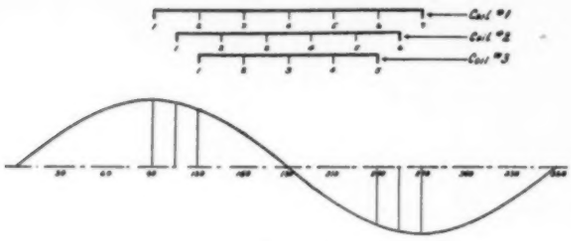


Fig. 12.

$C_p=(112.12+7.84-6.69-1.52+1.26-0.693+0.066+0.1175-0.158+0.0476-0.04+0.037)/\frac{1}{2}\pi\times100=224.77/\pi\times100=0.712.$

For practical purpose, however, the pole constant C_p is found by dividing the plotted half field form into a certain number

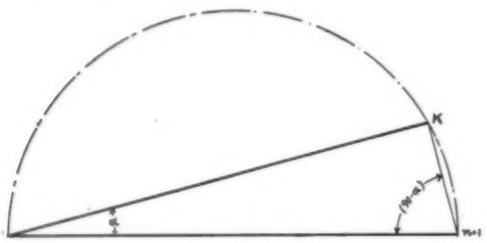


Fig. 13.

of parts (say six) having the same base, and adding the middle (mean) ordinates of these strips.

Referring to Fig. 6 these mean ordinates correspond to the odd numbers of the twelve divisions. We have

$$B_1+B_3+B_5+B_7+B_9+B_{11}=B_{ave}\times6.$$

Hence

$$B_{ave}=\Sigma B/6$$

$$C_p=B_{ave}/B_{max}=B_{ave}/100=\Sigma B/600.$$

For the field form, Fig. 6, we obtain, using this method,

$$C_p=100+100+100+77+44+11/600=432/600=0.72$$

As will be noted, this value for C_p checks so well with that found by the more elaborate method that we are justified in using this practical method to determine the pole constant.

Determination of Form-Factor.

The form-factor, f_b, is the ratio of the root-mean-square (r.m.s.) to the algebraic mean ordinate taken over one-half

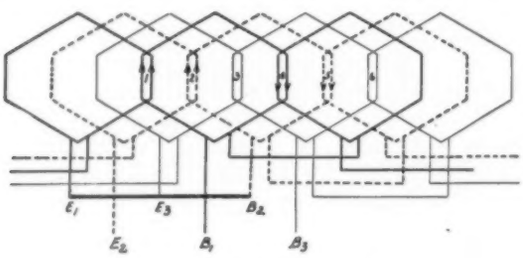


Fig. 14.

cycle beginning with the zero value, and is defined through the formula (see Fig. 7).

$$f_b=\frac{\sqrt{\frac{2}{T}\int_0^{T/2}B^2dt}}{\frac{2}{T}\int_0^{T/2}Bdt}$$

As in our case the field curve repeats itself every 90 electrical degrees, or every one-fourth cycle, it is obvious that we only have to integrate over $T/2$ instead of over T. For the same reason as explained before the above equation can not readily be solved without having the field form resolved into its fundamental and higher harmonics. For practical purposes, however, we apply a method similar to that used in determining C_p, that is, take the r.m.s. value of the ordinates

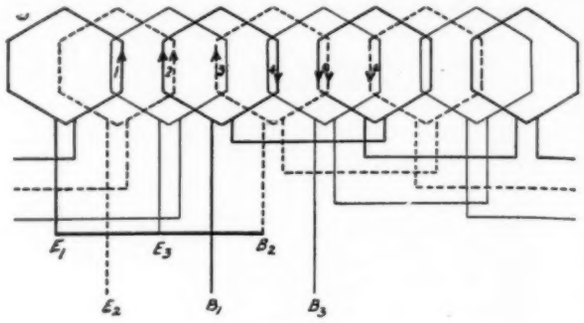


Fig. 15.

(B_1, B_3, etc.) and the mean ordinate. Referring to Fig. 6 we get

$$B_{rms}=\sqrt{\frac{B_1^2+B_3^2+B_5^2+B_7^2+B_9^2+B_{11}^2}{6}}$$

$$=\sqrt{\frac{100^2+100^2+100^2+77^2+44^2+11^2}{6}}$$

$$=\sqrt{\frac{37986}{6}}=79.5$$

$$B_{ave}=(100+100+100+77+44+11)/6=72.$$

Therefore

$$f_b=79.5/72=1.105.$$

For sine curves

$$f_b=1.11.$$

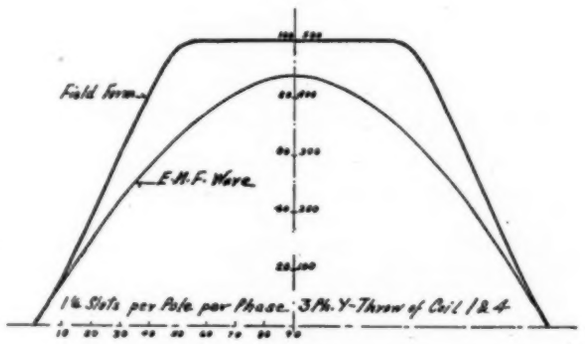


Fig. 16.

Determination of the Spread-Factor.

Due to the distribution of the armature winding there exists a certain phase displacement between the instantaneous induced electromotive force of conductors located in different armature slots. This phase displacement corresponds to the angular displacement of the armature slots. Hence the induced electromotive force per phase is the resultant vectorial sum of every individual electromotive force. The ratio between geometrical (E_G) and the arithmetical (E_A) sum of the different induced electromotive forces may be called the "spread-factor."

If we have one slot per pole per phase, then the spread-factor, $f_w=1$; if we have two slots per pole per phase, or six slots per pole for a three-phase machine, then there exists a certain phase displacement between the instantaneous electromotive forces induced in the conductors in series in the two slots.

The angular displacement of the slots in this case is 180/6= 30 degrees. Assuming one conductor per slot and the instantaneous induced voltage of each conductor equal to 1, we

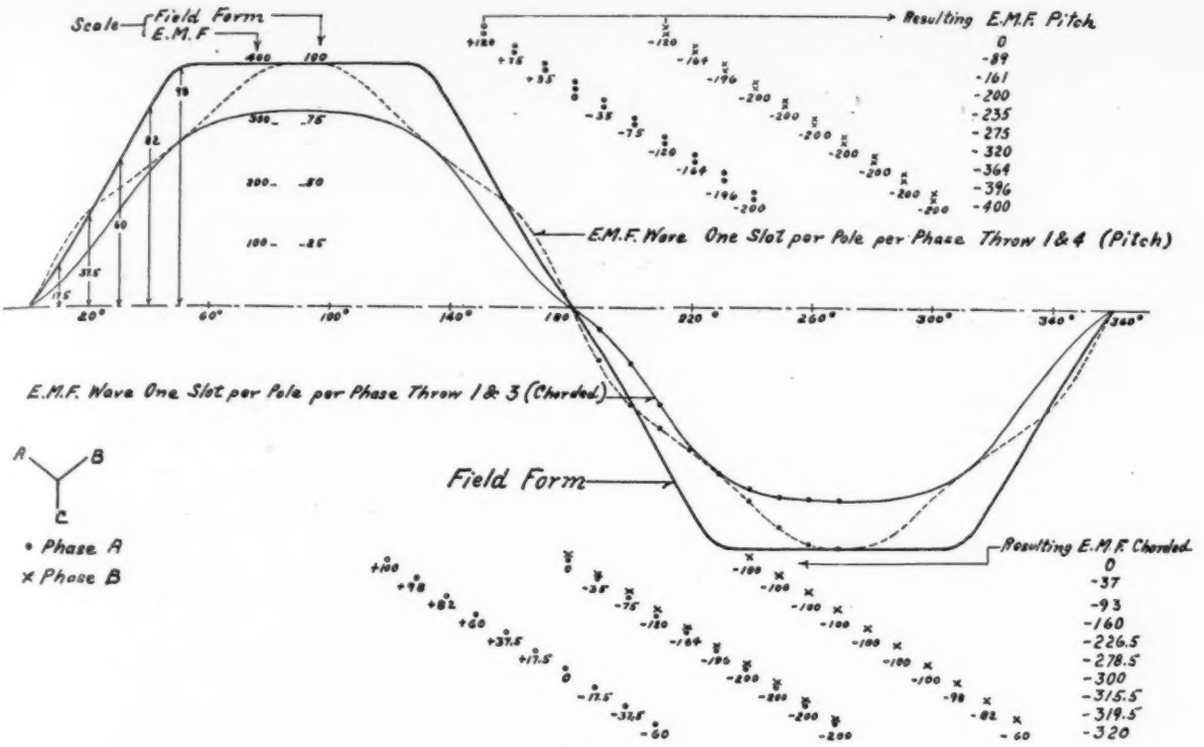


Fig. 17.

have the resultant geometrical sum $E_G=2\cos 15°=2\times 0.9659$. $E_A=2$; therefore $f_w=2\times 0.9659/2=0.9659$.

For a two-phase connected machine we would have conductors of three slots in series and

$$E_G=2\cos^2 15°+\cos 30°=2.73$$

$$\text{or } 2\cos 30°+1=2.73$$

$$E_A=1+1+1=3.$$

$$f_w=E_G/E_A=2.73/3=0.91.$$

(See Figs. 9 and 10 for graphical construction.)

Fig. 11 gives f_w for two and three phases for different numbers of slots per pole.

Determination of Chord-Factor.

For a sinusoidal wave, chording the armature winding or using short or fractional-pitch coil reduces the number of effective conductors in the ratio of the sine of the half angle of the electrical degrees between the two sides of the coil. Fig. 12 shows an arrangement of six slots per pole and three coils of different throw in a balanced relation. The throw of coil No. 1 is 1 and 7, which is the pitch embracing 180 electrical degrees.

Coil No. 2 is chorded one slot, having a throw 1 and 6 and embracing 150 electrical degrees. Coil No. 3 is chorded two

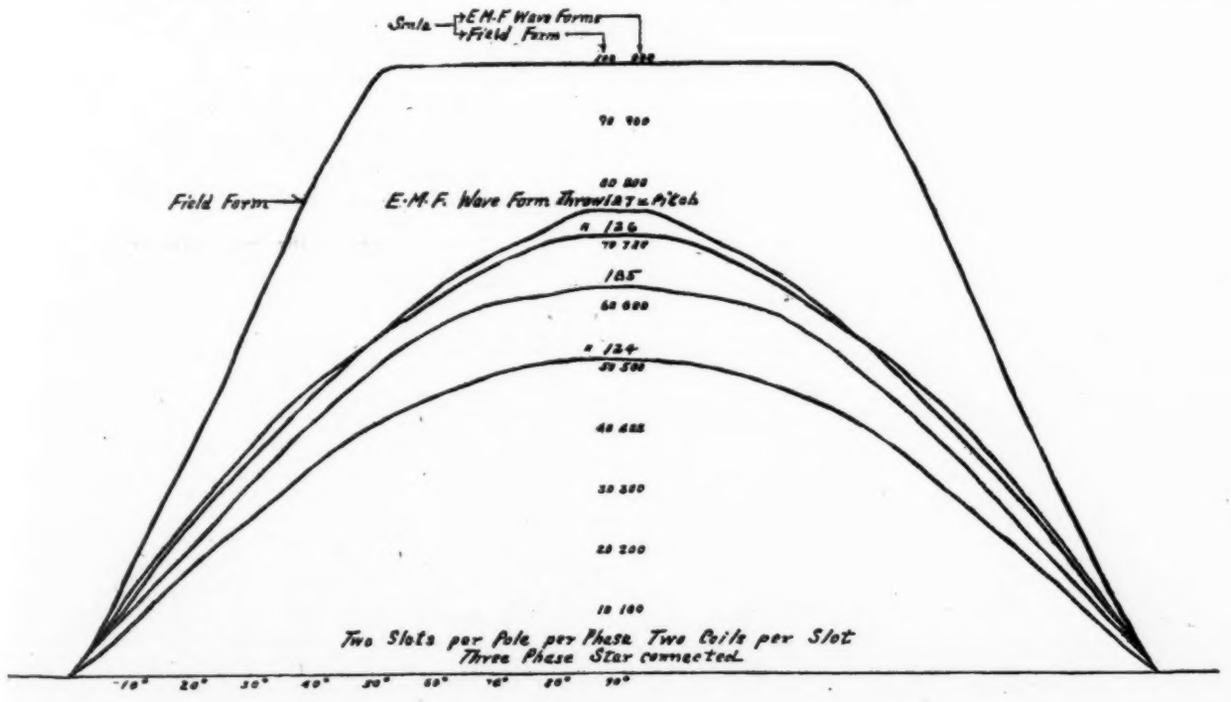

Scale—E.M.F Wave Forms
Field Form
Field Form
E.M.F. Wave Form Throw 1&7 = Pitch
Two Slots per Pole per Phase Two Coils per Slot
Three Phase Star connected

Fig. 18.

slots, having a throw 1 and 5, embracing 120 electrical degrees.

Let us investigate the instantaneous electromotive force induced in the coils at the momentary positions shown in Fig. 12. Denoting maximum induced electromotive force one and assuming the coils to have one turn only, we have the instantaneous electromotive force induced in one coil side

Coil No. 1: 1 sin 90°=1 sin 180/2=1.

Coil No. 2: 1 sin 105°=1 sin 75=1 sin 150/2=0.966.

Coil No. 3: 1 sin 120°=1 sin 60=1 sin 120/2=0.866.

As a pitch coil will have the maximum possible voltage induced, its chord-factor is equal to 1. For the chorded coil the chord-factor is the ratio between the induced electromotive force of this chorded coil and a pitch coil, or

f_c (coil No. 1)=1.

f_c (coil No. 2)=0.966/1=0.966.

f_c (coil No. 3)=0.866/1=0.866.

If we have n slots per pole, then the throw of pitch coil is 1 and $(n+1)$. Then throw of the chorded coil is 1 and K, we have then (see Fig. 13),

$f_c=\cos\alpha=\sin(90-\alpha)=\sin 180(K-1)/2n=\sin(K-1)\times 90/n$.

Determination of Wave Form of Electromotive Force.

If the field form or the flux distribution curve is sinusoidal, then the electromotive force wave generated by same in the armature winding will also be sinusoidal, independently of the armature winding distribution or number of slots per pole per phase and the throw of the coils. If, however, as is generally the case, the field form is not sinusoidal, then the distribution of the armature winding, the chording of same and also the connection of phases has an important effect on the electromotive force wave form.

The field form being determined by a method explained before, this effect can easily be analyzed by moving the armature winding, or rather conductors in series which have the same direction of the electromotive force induced, through this field and plotting the resultant instantaneous values of the electromotive force. Obviously the electromotive force wave induced in each conductor is exactly of the same shape as the field form itself. If more conductors than one, connected in series, are moving in the magnetic field, the resultant electromotive force will be the sum of the instantaneous values; therefore the resultant electromotive force is dependent on the number and distribution of conductors forming one group or winding element. Let us for example investigate the electromotive force wave form as generated by non-sinusoidal field form, Fig. 6, of a three-phase, star-connected winding having one slot per pole per phase with throw of coil 1 and 4, or pitch, Fig. 14, and throw 1 and 3, or chorded one slot, Fig. 15. There are two coils per slot and assuming, for convenience, one turn per coil, we will move one winding element (four conductors in series) through this field and plot the instantaneous values for every 10 electrical degrees over one-quarter of a cycle. Fig. 17 shows this method of construction without further comment.

Fig. 18 shows the effect of two slots per pole per phase for a three-phase star-connected winding with different throw of coils. It should be noted that throw 1 and 6, or chording of about 83 per cent of pitch, shows the best wave form.

If we, however, apply an armature winding having 5/4 slots per pole per phase or 15/4 slots per pole, we would for a throw of coil 1 and 4 obtain a very good wave form, Fig. 16, having a maximum deviation from equivalent sine wave of 0.74 per cent; in fact, a wave form having the same characteristics as would result from a three-phase star-connected winding having 15 slots per pole and a throw of coil 1 and 13. Fig. 11 also indicates this. Such a part-slot or fractional-slot winding (5/4 slots per pole per phase) would also be quite welcome if the pole pitch be small, and can be applied in case of three-phase winding to any machine where the number of poles is four or a multiple of four.

Fig. 19 shows the effect and distribution of a part-slot winding for two phases for a 10-pole machine having 72 armature slots and a field form typical for such a machine. For information regarding fractional-slot, fractional-pitch winding, see the article by Justin Lebovici in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, September 23, 1916.

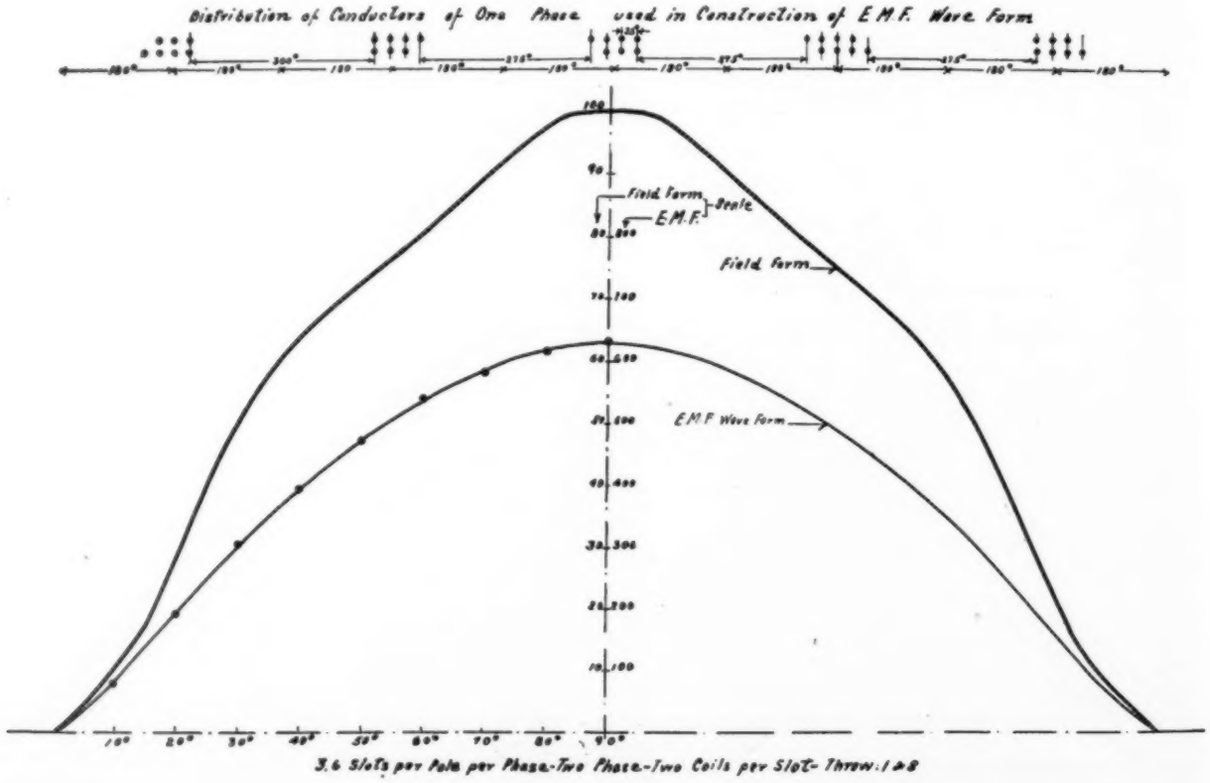

Distribution of Conductors of One Phase used in Construction of E.M.F. Wave Form
Field Form
Scale
E.M.F.
Field Form
E.M.F. Wave Form
3.6 Slots per Pole per Phase-Two Phase-Two Coils per Slot-Throw: 1 & 8

Fig. 19.

COMMERCIAL PRACTICE

New-Business Methods, Policies, Rates and Kindred Central-Station Matters for the Man Engaged in Selling Electricity

ESSAY CONTEST FOR TOY ELECTRIC RANGES MEETS WITH SUCCESS.

Considerable Interest Created in Electric Cooking and Many Range Prospects Secured.

During America's Electrical Week the Texas Power & Light Company, Dallas, Tex., conducted, in 16 of the districts where it operates electric light properties, essay con-

Winner of One of the Junior Electric Ranges in Texas Contest—Mother Also Uses An Electric.

tests among the school children, offering as prizes 16 Western Electric Junior electric ranges.

This contest was conducted with three ideas in view:

(1) To get the children, and hence the mothers interested generally in the subect of electric cooking.

(2) To secure new advertising ideas from the other person's viewpoint.

(3) To foster general good will in connection with the Christmas season.

The contest was a success in practically every district where it was conducted, and not only was much valuable publicity obtained, but many ideas submitted by the children will be used in the company's advertising during the year.

Four subjects were selected, each of these being used in four districts. These were as follows:

(a) What I Would Do with a Toy Electric Range.

(b) Electricity in Everyday Life.

(c) How Mother Might Use Electricity to Lessen Her Work.

(d) Why Mother Should Have An Electric Range.

The contests covered a period of two weeks, during which time the rules were advertised in the newspapers and by means of window displays. In the majority of cases the essays were turned over to the city officials or to the local school authorities, who acted as judges and made the decisions as to the best essays.

In every district the local newspapers carried news items announcing the contest, and also in the majority of cases published the winning essays, with the name of the winner.

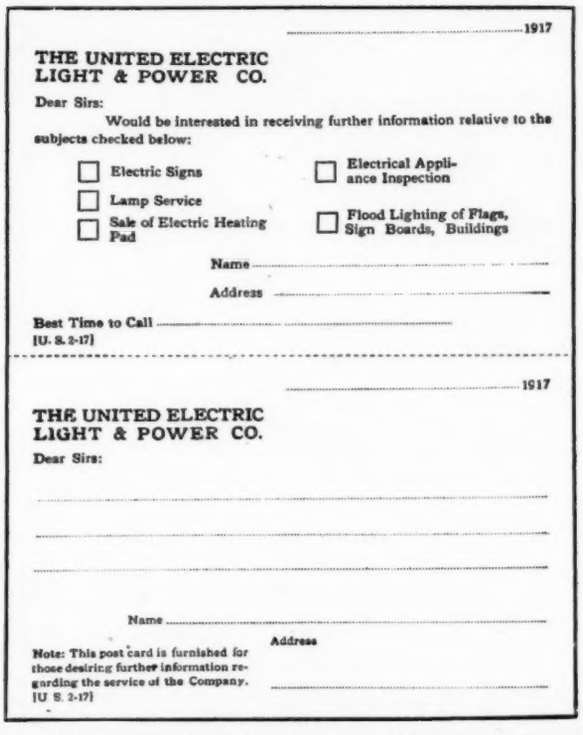
In order to further call attention to electric cooking and to compensate in a way for the disappointment of those children who were unfortunate in winning a prize, a personal letter was sent to all unfortunate contestants by the manager of the district, expressing regret that the recipient did not win the prize.

The names of the contestants will be used in connection with the electric cooking campaign now under way, as they will form an excellent avenue of approach to the mothers.

Checking Returns of Appliance Advertising by Post Cards.

As a means of interesting its customers in various electrical appliances and applications, the United Electric Light & Power Company, of New York, N. Y., devotes considerable space each month in its house organ, entitled "United Service," to descriptions of timely appliances and interesting accounts of electrical installations of particular note. A practice which has been adopted recently, and which is proving of considerable value, is that of deciding on some special appliance to be featured each month and giving prominent space to a description of this device in the company's publication.

As a means of checking the returns from this form of advertising, the company incloses with each issue a double return self-addressed post card, such as is shown in the accompany-



.....1917

THE UNITED ELECTRIC LIGHT & POWER CO.

Dear Sirs:

Would be interested in receiving further information relative to the subjects checked below:

☐ Electric Signs ☐ Electrical Appliance Inspection

☐ Lamp Service

☐ Sale of Electric Heating Pad ☐ Flood Lighting of Flags, Sign Boards, Buildings

Name .....

Address .....

Best Time to Call .....

[U. S. 2-17]

.....1917

THE UNITED ELECTRIC LIGHT & POWER CO.

Dear Sirs:

.....

.....

.....

Name .....

Address .....

Note: This post card is furnished for those desiring further information regarding the service of the Company.

[U. S. 2-17]

Self-Addressed Post Cards Used by United Company In Connection With Its House Organ.

ing illustration. The card reproduced was sent out with the February issue, the special for this month being a $7.00 electric heating pad which is sold during February for $5.44.

Electric Signs Popular in Salina.

During the last six months Salina, Kans., merchants have installed 18 electric signs with a total of 5,100 Mazda lamps, and orders for four more signs have just been secured by the Salina Light, Power & Gas Company.

Handling Customers' Appliance Repairs

Policy of the Commonwealth Edison Company of Giving Prompt Repair Service Is an Important Item in Increasing Revenue from the Use of Domestic Devices—Well Organized Department a Feature

By J. N. WALTON
Commonwealth Edison Company, Chicago

THE operation of that branch of the Commonwealth Edison Company's customers' service and repair department having to do with the repairing of household heating devices, extends over a larger field than one might at first suppose. First, it must be considered that all of the heating appliances which are used in Chicago and which consume Edison current, were not purchased from the Commonwealth Edison Company. The repair department stands back of the guarantee placed on articles sold by the company when such guarantee covers the replacing of defective material or the repairing of broken parts due to defects. But it goes still farther than that. It repairs any heating appliance no matter where it was originally purchased, providing it is being used on Edison service and parts may be obtained from the manufacturer.

The policy adopted by the Edison company in making repairs on heating devices is about as follows: All articles which are under guarantee by the manufacturers and can be repaired in one hour or less, are repaired free of charge. Any article which is not guaranteed by the manufacturer or upon which the guarantee has expired, or any article which has become defective or broken due to careless handling, is repaired only upon the customer's agreement to pay for such repairs.

How Calls Are Handled.

The cost of making repairs in the latter case varies according to the cost of the material required. The labor necessary to pick up, deliver and repair the article is not charged for unless repair work consumes more than one hour. In some cases, as for instance, replacing broken connector plugs, a universal price of 50 cents has been established in order to save confusion and errors which would arise from a large and varied price list.

Calls for repairs are received by the Service Bureau. They are immediately turned over to the work dispatcher, who is located in the same office and the calls receive the same attention that "lights out" complaints do. The repairmen report to the work dispatcher by telephone every hour and receive the calls in their district, also reporting what was done on the ones they have already received. All repairmen carry a supply of flat-iron cords of various kinds, on their rigs so that instead of picking up the cords and sending them into the shop, they can be exchanged on the first call. The old cords thus exchanged are sent in and repaired and placed in the repairman's stock again. Repairs and adjustments of a minor nature are also done on the customer's premises, but if an article requires new parts or work for which the repairman is not equipped, a tag, shown herewith, is filled out and attached to the article, a stub bearing a number corresponding to one on the tag is given to the customer as a receipt and the article is sent to the shop. If charges are necessary, the customer's order is obtained by the repairman and the order is attached to the tag.

All articles thus picked up are forwarded to and reach the shop on the following morning. Here a record is made on a card showing the name, address, description of article, tag number, date brought in and repairman's name. This card which is shown herewith, is placed in a pending file until the article is repaired, after which a report of what was done, material used, etc., is entered and an order made out to deliver article to the customer. The card is then filed permanently under street address and the delivery ticket is forwarded to the work dispatcher. The article is sent to the repairman who reports delivery to the work dispatcher.

NAME ..... ADDRESS ..... FLAT .....
ARTICLE ..... TEL. No .....
WHAT WRONG .....
ORDER SIGNED YES NO SENT OUT FOR ORDER ..... 19..... REC'D ORDER ..... 19.....
DATE BROUGHT IN ..... 19..... CHECK No ..... SENT IN BY .....
REMARKS

DATE REPAIRED ..... 19.....
MATERIAL USED .....
.....
TIME REQUIRED ..... HRS ..... MIN .....
REPAIRMAN

DATE SENT OUT FOR DELIVERY ..... 19..... ACCOMPANIED BY ORDER YES - NO ORDER RETURNED ..... 19.....

Card for Keeping Record of Repair Work Sent to Shop.

This procedure, from the time the article is picked up to time of delivery, ordinarily requires three days.

System for Billing.

After articles have been repaired for which charges are to be made to the customer, the signed orders are forwarded to the repair department office and the customer is billed. Seven copies of each bill are made out, five of which are sent to the stores department for proper record and distribution. A store-room credit accompanies each day's bills, transferring the credit to the heating-device repairs account. One copy of the bill is attached to the customer's signed order and is filed by bill number in the repair department. One copy is kept by the shop foreman for his reference.

The repair shop is located in the down town district. It is equipped with all machinery and testing apparatus necessary to make repairs of all kinds on heating appliances. A stock of repair parts and materials is also kept there and it probably consists of the most complete assortment of heating-device repair parts in the country. Most of this stock is ordered through the purchasing department from the manufacturer direct.

New heating elements, connectors, plugs, handles and cords are the parts most frequently used and when it is considered that each manufacturer has several models, the parts of which are not interchangeable, some idea of the diversified stock is apparent.

The repair department performs another important function in considering the selection of articles which are to be offered for sale. Complete statistics are kept regarding the repairs of all devices, showing the number of various kinds of appliances repaired and how they were defective.

Form R D 8 8-10 16-10M

COMMONWEALTH EDISON COMPANY

REPAIR CHECK

No. 9607

CUSTOMER'S SERVICE AND REPAIR DEPT.

28 N. Market Street

Name

Address

Floor Tel. No.

Article

DESCRIBE CONDITION OF ARTICLE ON REVERSE SIDE

Repairman

Charges YES NO DATE PICKED UP

COMMONWEALTH EDISON COMPANY

Repair Check

No. 9607

CUSTOMER'S SERVICE AND REPAIR DEPT.

28 N. Market Street

THIS CHECK MUST BE PRESENTED WHEN GOODS ARE DELIVERED

TELEPHONE RANDOLPH 1280

(DUPLICATE)

Repair Tag Given to Customer When An Appliance Is Removed to Shop.

Suggestions for improvement in the construction of the articles can be taken from these statistics and it also gives the company good information as to which ones are desirable to offer for sale.

ORDER FOR REPAIRS TICKET NO.

DATE 191

COMMONWEALTH EDISON COMPANY,
CUSTOMERS' SERVICE AND REPAIR DEPARTMENT.

PLEASE FURNISH THE FOLLOWING MATERIAL AND MAKE NECESSARY REPAIRS IN THE PREMISES

AT FOR WHICH I AGREE TO PAY $

UPON PRESENTATION OF BILL.

NAME

PER

ADDRESS

NOTE—Bill will be rendered to party signing here.

BILL TO BE RENDERED TO
TO BE PRINTED.

ADDRESS

REPAIRMAN

DATE COMPLETED 19

ABOVE MATERIAL HAS BEEN SATISFACTORILY INSTALLED:

SIGNED

Form R D 6

Order Filled In By Repairman On Customers' Premises.

The repair department therefore is one of the important spokes of the wheel which revolves around the hub of satisfied customers. The aim of the department may be stated as follows: To advance the present high standing of the company in the minds of the people; to render cheerfully any service that may be required; to treat everybody with the highest courtesy; to protect life and property; to maintain service, and to repair customers' wiring and appliances.

Development of Motor Load of the San Diego Consolidated Gas & Electric Company.

The commercial department of the San Diego (Cal.) Consolidated Gas & Electric Company, superintended by A. E. Holloway, has recently secured some large power business which calls attention to the wonderful development of the power load of the company in the last few years. One of the recent power installations to be secured is a load of 640 horsepower for the government wireless station, which began operation in January. This is said to be one of the largest and most powerful wireless stations in the world. The department has also closed with the San Diego & South Eastern Railway Company for energy to the extent of 750 horsepower at Chula Vista for the operation of its railway. The Hercules Powder Company has contracted for electric power amounting to 1,000 horsepower, which will be operated 24 hours per day. The company will install 350 kilowatts in electric furnaces in the near future, which will also be operated 24 hours per day.

In addition to these installations the company has secured a large number of smaller power contracts for manufacturing and commercial purposes, and at the present time has prospects for the immediate closing of several thousand horsepower additional.

On January 1, 1910, the San Diego Consolidated Gas & Electric Company had a total connected power load of 983 horsepower. On January 1, 1917, the total power load served by the San Diego company had increased to 20,162, a gain of 2,000 per cent in the seven years. During this period the largest increase in one year was 3,411 horsepower and the minimum increase 2,100 horsepower, showing a steady, consistent growth.

This power development has been due partially to the conversion of private power plants to central-station service and partially to the securing of new industries. San Diego is not a manufacturing city, and the company power's business has been built up from small customers, such as garages, machine shops and pumping plants.

In 1910 there was a great number of distillate and steam

engines in and about San Diego, and there was located in the city of San Diego a plant for the manufacture of distillate engines, which sold its entire output in the San Diego territory. Fuel for these engines could be obtained at five to eight cents per gallon, delivered to the customer at his engine. The company had very hard competition from this source, but has succeeded in replacing practically all distillate engines and steam plants in the territory. There are very few steam and oil installations remaining, and no isolated electric plants, the last one having been replaced by the company's power about six months ago.

In 1911 the company started to extend its power lines to the agricultural districts around the city of San Diego to reach pumping plants which at that time were all operated by gasoline engines. Today practically all of these plants are operated by electric drive.

HOW A UTILITY CAN AWAKEN CIVIC INTEREST.

Activities of Merchants Heat & Light Company in this Direction Winning Thousands of Friends.

An interesting study in the power of a public utility company to exert a tremendous civic influence beyond and apart from its peculiar field of business has been offered in the last year by the Merchants Heat & Light Company, of Indianapolis, Ind. In its window displays, showing the evolution of Indianapolis-manufactured products from the raw material to the finished stage, the company has taught citizens things that most of them did not know about the range and variety of the city's manufacture. Then, last summer and fall, the company became one of the prominent agencies in awakening interest in the celebration of Indiana's centennial, lending its employees and a part of its office space to the promotion of the pageant held at Riverside Park as part of the Indianapolis celebration. On election night the company took another step out of the customary path traveled by public service corporations and displayed bulletins, winning the enthusiastic gratitude of thousands of persons for this small, but at the same time important, piece of community service.

Still another step in showing that a utility company's civic interest is not necessarily confined to making and distributing a certain commodity is the thrift campaign which the Merchants company has carried on for several weeks with the aid of the motograph sign on top of its office building at Washington and Meridian Streets. The motograph can be made the city's most insistent civic teacher. It talks to tens of thousands instead of hundreds, and sooner or later it is seen by almost every citizen. So it becomes an excellent medium for impressing civic truths.

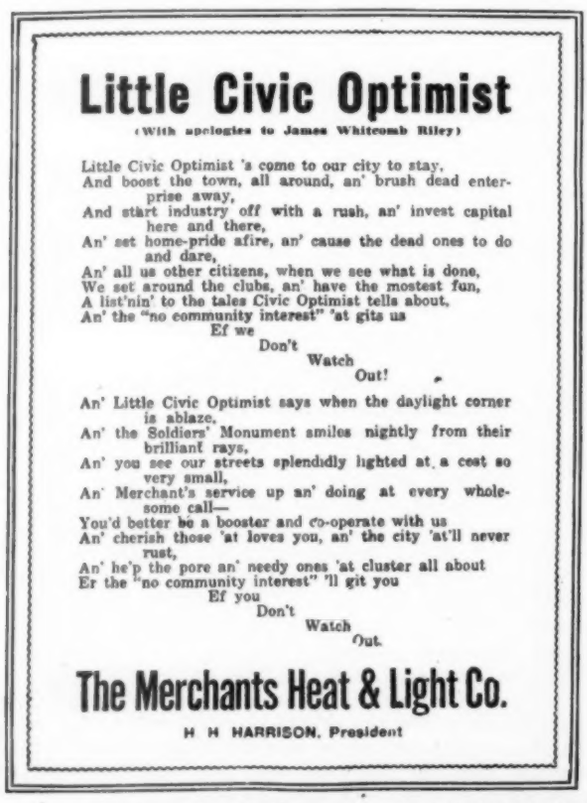
The thrift campaign, with epigrammatic utterances from prominent bankers of the city, is unique among electric-sign campaigns in the whole country. Never before has a sign been given over for a considerable period to publicity for a thing like thrift. Never before in any community, has the same kind of intensive argument for thrift been attempted. In the largest sense these electrical "talks" encouraging habits of thrift in the individual have been of direct civic value, for any community's prosperity and the level of its citizenship are dependent on the margin between money earned and money spent. These talks, incessantly flashed for many nights, must have a direct effect of stimulating the savings habit. Bankers of Indianapolis have recognized the fact, and have been able in some instances to trace new accounts directly to the economy talks on the motograph.

The thrift talks in their entirety represent probably as fine a collection of compressed ideas about saving money as can be found in recent banking literature.

Concord Municipal Plant Reduces Rates.

The municipal light department of Concord, Mass., has put into effect a new and lower cooking and heating rate of 3 cents for the first 50 kilowatt-hours per month, 2.5 cents for the next 50, and 2 cents for all over 100.

The power rate runs from a maximum of 5 cents, down to 2 cents for over 5,000 kilowatt-hours per month.


Little Civic Optimist
(With apologies to James Whitcomb Riley)
Little Civic Optimist 'a come to our city to stay,
And boost the town, all around, an' brush dead enterprise away,
And start industry off with a rush, an' invest capital here and there,
An' set home-pride afire, an' cause the dead ones to do and dare,
An' all us other citizens, when we see what is done,
We set around the clubs, an' have the mostest fun,
A list'nin' to the tales Civic Optimist tells about,
An' the "no community interest" 'at gits us
Ef we
Don't
Watch
Out!
An' Little Civic Optimist says when the daylight corner is ablaze,
An' the Soldiers' Monument smiles nightly from their brilliant rays,
An' you see our streets splendidly lighted at a cost so very small,
An' Merchant's service up an' doing at every wholesome call—
You'd better be a booster and co-operate with us
An' cherish those 'at loves you, an' the city 'at'll never rust,
An' he'p the pore an' needy ones 'at cluster all about
Er the "no community interest" 'll git you
Ef you
Don't
Watch
Out.
The Merchants Heat & Light Co.
H H HARRISON, President

"SEEIN' THINGS"
(With apologies to Eugene Field)
I ain't afeard uv electric stoves, or irons, or grills at any price,
An' things granmuver wuz skeered uv I think are awful nice!
I'm pretty brave, I guess; an' yet I hate to pass the electric shops
An' see the various beautiful appliances in dozen lots;
My neighbor says: "Look!"—an' takes me to the Daylight Corner Lights
An' leaves me standin' all alone, seein' great electric sights!
I saw Civic Pessimists appear and shout in at that door,
I saw them all a-standin' in the middle uv that floor;
Sometimes they were a-sittin' down, sometimes they were walkin' round
So boldly an' so rampant they made an awful sound!
Sometimes they painted the city black, an a few times they saw it white,
But the color ain't no difference if you just see things right!
The Merchants Heat & Light Co.
H. H. HARRISON, President

Two Recent Advertisements of the Merchants' Heat & Light Company Intended to Stimulate Civic Interest.

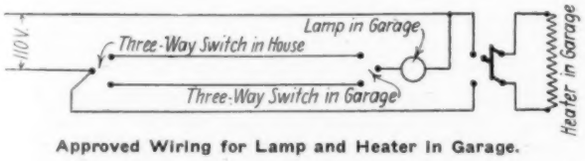
ELECTRICAL CONSTRUCTION

A Department Devoted to Problems Relating to the Installation, Operation and Maintenance of Electrical Equipment

Additional Loading of Circuit Without Interfering with Intermediate Three-Point Switch.

A short illustrated article on this subject, written by Paul Justus, of Cleveland, O., was published in our issue of January 20, 1917. It described a simple method of wiring a small automobile-engine heater in a garage so that the heater could be supplied from the same circuit, but was controlled independently of the lamp in the garage, which lamp was governed by a pair of three-way switches. It has been called to our attention that this method of wiring is not in accord with the National Electrical Code, rule 24c (third paragraph) of which states that "three-way switches are considered as single-pole switches." The arrangement suggested in the article by Mr. Justus makes use of these switches as double-pole switches with 110 volts, or the full circuit voltage, constantly impressed on their terminals. In other words, the switches in this case do not disconnect the lamp that is being controlled, but merely short-circuit it in order to put it out, while leaving it all times connected to one or the other side of the circuit. Three-way switches, being intended for and designed as single-pole switches, do not have the construction required of double-pole switches which must entirely disconnect both sides of the circuit controlled.

Since the proposed method of wiring is not recognized as good practice, and will not be approved by electrical inspectors, it is unfortunate that these points were inadvertently overlooked when the article was accepted for publication. Assuming that the combined load of the lamp or lamps on the circuit and the heater was not more than 660 watts, the allowed maximum loading of branch circuits, the best method of wiring in this case is that shown in the accompanying diagram.



Approved Wiring for Lamp and Heater in Garage.

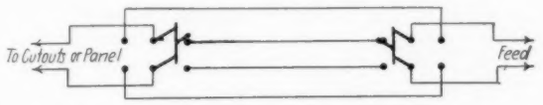
Wiring for Control of Heavy Circuits from Two Locations.

By James D. Lynett.

The problem occasionally presents itself to the electrician of controlling an important or fairly heavy circuit from two locations. The National Electrical Code does not permit the use of single-pole switches to control a circuit of more than 660 watts, and the Code considers a three-way switch as a single-pole switch. Consequently, many electricians are at a loss as how to wire for this condition properly. The following method, while not new, may therefore be helpful to some.

The accompanying diagram shows how it is possible to control several circuits from two different locations without the use of three-way switches and still have the same control as a set of three-ways, and at the same time comply with the Electrical Code. It consists merely in the use of a pair of double-pole, double-throw switches wired as indicated and installed in approved cabinets.

This system can be used to great advantage in moving-picture theaters to control the house lighting. One switch is installed in the operator's booth and the other down stairs in the manager's office. When the operator is ready to start the show he can throw off the house lighting by pulling out the switch in his booth, and in case of a fire or panic in the theater or for any other reason the manager can instantly light up the house by throwing in his switch, which will save the time of running up to the booth or calling to the operator to switch on the lights.



Wiring for Controlling Heavy Circuit from two Points.

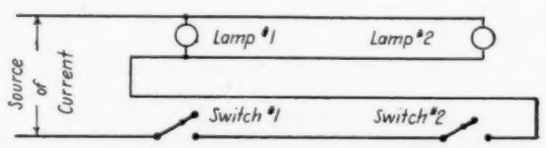
Of course, it is understood that the switches must be heavy enough to carry the required load, also that each switch must always be kept closed in one position or the other, never left open.

Signals for Simultaneous Test Readings.

By W. S. Doxsey.

When two testers are working together on the same test job various methods of signaling have been employed to indicate when readings and adjustments are to be made. Delay and confusion often result, particularly if two readings or adjustments have to be made simultaneously. Take a specific example: In calibrating watt-hour meters, the readings must be taken when the current and the voltage are adjusted to certain predetermined values. One operator signals the other as soon as he has the desired reading on the standard meter; the second operator adjusts his instrument and a reading of the meter being tested is made. If during the interval of signaling the current or voltage varies, an erroneous reading of the unknown is taken.

To eliminate this source of error, place a lamp before each operator. Switches connected in series in the circuit of the lamps are provided for each tester. Thus, when adjustments are made, the first operator presses his switch, and if the other operator has made his adjustments and presses his switch, the lamps light and readings are taken without confusion or delay. This scheme may be varied to suit many different kinds of testing. In any case it expedites the work and removes one of the sources of greatest errors.



Lamp-Signal Wiring for Two Test Stations.

Miniature lamps operated on a low-voltage battery circuit may be used for this signaling. In this case contact keys or push buttons may be used in place of switches. If a circuit of more than 20 volts is used, switches must be employed. These may be of the plain single-pole baby type.

Setting an Intelligent Selling Price

Importance of Knowing the Costs of Conducting the Business in Order to Avoid Bankruptcy and How a Scientific System of Keeping Costs May be Co-operatively Developed for Contractors

By GEORGE W. HILL

NEARLY a year ago there appeared in this journal several articles by the author pertaining to the advisability of having kept in every business a proper record of all business transactions in such form as to afford the owner or manager an opportunity of viewing them in a general way and knowing the condition of the business at a glance, thus having, as it were, his finger on the pulse of the business to such an extent that he would be in a position to detect any unusual or alarming condition which might creep in.

It is the contention of the writer that a good bookkeeping system is one of the most essential things in any business. It is to the contractor just what the compass is to the sea captain. It guides his course, and those who have attempted to make the voyage across the great business seas without it have landed sooner or later upon the rock-bound coast of some unknown land and they have seen their frail crafts pounded to pieces upon the rocks of bankruptcy.

Must Know Costs to Set Intelligent Selling Price.

E. N. Hurley, until recently vice-chairman of our Federal Trade Commission, has brought this matter to the attention of the American business man with more force than perhaps any other individual, and the reason for this is because Mr. Hurley was in a position to know the conditions better than many. He said: "Teach the business man to know his costs so that he may be able to set an intelligent selling price," meaning, we presume, a selling price which takes account of all costs and a reasonable profit. There have been numerous governmental investigations of trade conditions, but in my opinion the present investigation and ultimate plan of furnishing the business man with scientific knowledge of how to keep his accounts is the most important of all.

The high cost of living has led us to believe that there are those in business who are charging exorbitant prices, but from the startling statement made by Mr. Hurley it would appear that these men are sadly in the minority, and that a very large portion of our business men were not charging enough. It would seem that this is all due to the lack of a complete yet simple system of keeping accounts and determining costs.

Better Not Undertake to Sell Than Sell at Loss.

It seems to be the disposition on the part of very many of the younger and less experienced contractors, and many of the older ones too, to learn how much their customers will pay or their competitors are asking. This no doubt should have some bearing in the case, but the first question should be: "How much does this article cost me?" Then set a figure that will give you a reasonable selling price and reasonable profit. If it is then found that your competitor is still selling this article at considerably less, you should look into the matters of buying, economical management, operating expense, delivery and everything affecting the cost of this article to you. Be sure that you are only asking a reasonable profit. If upon this investigation you find that you cannot make any material change in your cost mark or your selling price, you can be quite sure that your competitor is selling that article at a loss, and it would be advisable to allow him to do so. But before you allow him to continue to sell this article at an apparent losing price you should be absolutely sure that you are not wrong, and to do this you must know your costs and this can be accomplished only by the use of a good cost system.

Typical Case of Ignorance of Costs.

The writer called on a so-called small business man a few days ago and in the course of conversation something was said about the cost of operating his business. I remarked that owing to the nature of his business he must have a high overhead or operating expense. He said: "Oh, I don't know. I don't think it is costing me very much to run this business." I said to him: "I see you have some very fine candy here. What do you sell those boxes for?" He replied that he bought them at 80 cents per box and sold them for $1, making 25 per cent profit on the cost. We talked on about the price and cost of several different articles he was handling and I noticed that he did not have the proper conception of how to set a price. I said to him: "What percentage of overhead do you add to your factory costs plus your delivery charges?" He answered: "Well, I have never figured it up, but it doesn't amout to much. I am going to sit down some time and spend an hour to find out." I smiled. He asked me what I was smiling about. I replied: "I was just thinking how many hours it would require an expert cost accountant to come anywhere near your operating expense and how absolutely ridiculous it would be for you to sit down and to do this in an odd hour, some time when it came along. According to the amount of gross business you claim you are doing, and assuming you are figuring your cost and profit correctly, you should have so much money in the bank or in property over and above what you had last year." "Well, I can't say," he replied. "I don't really know. It seems like I have a lot more stock than was in the store last year at this time. It looks like it. I think my outstanding accounts are a little more and I have about the same amount of money in the bank."

Do you know, dear readers, that this is as much as a very large majority of merchants know about their business? Is it any wonder that Mr. Hurley feels that it is an alarming condition? Is it not time that our Federal Government feels it should do something to relieve the situation to the end that we should have less business failures and to place merchandising upon a more sound basis in this country? There is no doubt in my mind that if their exact costs were known by all electrical contractors throughout the country, their selling prices would be much higher than they are at present. I would therefore strongly advise the use of a good accounting system, a thorough cost system and then raise your prices.

Cost Ignorance Leads to Bankruptcy.

The lack of knowledge of costs has a greater tendency toward lowering prices and demoralizing business rather than raising prices. We find that those who attempt to know their costs under some circumstances submit low bids, and the fellow who does not know his costs follows suit, and this continues until it becomes ruinous to the whole business in that community. The fellow who does not know his costs permits the competitor to operate the

rudder or steering wheel and finally along the route the competitor who is doing the steering just ditches the whole thing, and so it goes. We find these wrecks lying along the great commercial highway, a record of them being kept in our bankuptcy courts, where, if the true cause were ascribed, we would find at the top of nearly every page "Lack of Knowledge of Costs and Unable to Set an Intelligent Selling Price."

If this were not true our Federal Trade Commission at this time would be devoting its entire time and attention to a most important matter, our foreign trade relations, or exterior trade conditions rather than interior trade conditions. It would not be working out the problem of providing each branch of industry in this country with a comprehensive bookkeeping system which is designed for the purpose, above all other things, of determining for our business men their costs that "they may be able to set an intelligent selling price."

Vastly Different Conditions in Other Countries.

We will not be able in this country to be guided altogether by the experience of those in other countries conducting similar lines of business, but working under entirely different conditions. Our American clerks, stenographers, bookkeepers, etc., demand as a rule much higher living conditions and must necessarily be paid more money. Our mechanics demand and receive more pay.

Our competitive system is also entirely different, and there is, so far as I am able to learn, absolutely no comparison in this regard between the electrical contractor and merchant in Germany or other progressive European countries and the electrical contractor in this country. The chief difference is that Germany is fortunate in having solved in a large measure the competitive system. The granting of permits to persons or firms operating any business is based upon the demand or possibilities in each community. In other words, if the community has, say, three electrical contractors and these are unable properly to handle the increasing business, then and not until then is additional competition permitted. This is based upon the broad principles of government protection and the final analysis of all human endeavor, *service*. The smaller business man learns to lean upon the strong arm of the government which has no doubt worked out to a reasonable degree of perfection the system of costs and profits based upon ability and investment.

Co-operation With Federal Trade Commission.

Owing to the great interest being taken by the Federal Government Trade Commission in better interior trade conditions, I believe it is the duty of every branch of industry in this country either individually or through its state or national associations to render every possible assistance and it should be deemed advisable at this time for every industrial association to appoint working committees to co-operate with the Trade Commission, supplying the latter with statistics, reliable data and all available information to assist in this work which will mean more to the business men than any move which has been set on foot in this country for the betterment of trade conditions. There are numerous large national organizations that are in possession of a wonderful amount of valuable information and which could wield an influence with their smaller affiliated organizations and members in securing the hearty co-operation of the entire industry.

All information for the benefit of the electrical contracting and merchandising business must come out of that business. In other words, we must secure the necessary data and learn how to apply scientific principles to our business and then we must conduct our business scientifically. That there is abundant knowledge in this country pertaining to the building up of any business to greater and more profitable proportions goes without saying. If Herbert Spencer's definition is correct, that science is organized knowledge, then we shall have a science, we shall have organized knowledge pertaining to the building up of our business, a science which we may name "the science of operating an electrical contracting and merchandising business."

There was a time when there was no science of agriculture. It has not been so long ago that our farmers laughed at the idea of scientific farming, but today we find agricultural colleges and experimental farms in nearly every state in the union. The science of agriculture is recognized today throughout the country, simply due to the fact that all of the knowledge pertaining to the why and how of farming has been brought together and is taught throughout the land. In other words, we have organized our knowledge on this subject into a science and it is needless to say that the farmer who conducts his farm on scientific principles is the most successful.

I believe that, if all of our national associations would make a concerted effort to bring about a scientific system of handling accounts and did nothing but this for some time to come, it would be the master stroke and would do more toward bettering conditions and uplifting and upbuilding of their respective lines of business than anything they could do at this time.

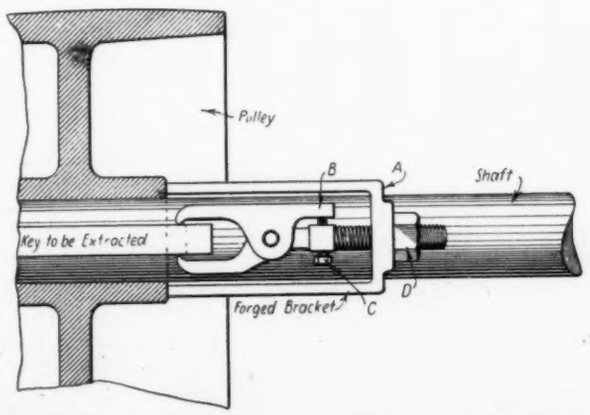
Let us have a committee from each of our organizations and then let us have a national conference of these committees, which will bring together facts about our business and show to our Federal Trade Commission that it may have the hearty co-operation and support of every electrical contractor.

Device for Extracting Tightly Fitting Keys from Pulleys.

By Emile Pilpel.

In the accompanying diagram is shown a device especially adapted to extracting keys from pulleys that are tightly fitted and inaccessible from the inner side of the pulley, as found frequently on line shafts bearing loose-and-fast pulleys, on electric motors, motor-generator sets, etc.

The outfit consists primarily of an inverted U-shaped forged bracket *A*, lying very closely to the shaft towards the key to be extracted and pressing against the boss of the pulley. After making an incision with a cold chisel, as con-



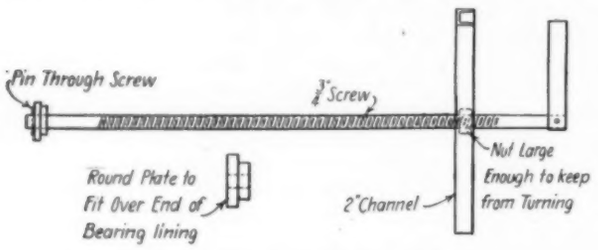
Device for Extracting Tightly Fitting Keys from Pulleys.

dition will demand, the jaws *B* are placed so as to grip tightly the key at the incision thus made, the jaws being secured by means of the set-screw *C*. Finnally, by aid of a wrench applied to nut *D*, pull is exerted on the jaws so gradually the key will give way. A one-inch machine screw with an extra wide nut will work satisfactorily in the most severe cases.

To Remove Bearing Linings from Motors.

By George Mackenzie.

A tool that I have found convenient for pulling out the bearing linings of motors without injuring them is shown in the accompanying sketch. It was made from parts that were found lying about in the shop. It consists of a three-fourths-inch screw with a handle at one end and a removable round plate and pin at the other end. The screw passes through a square nut large enough to fit without turning in a two-inch



Screw Device for Removing Bearing Linings.

channel-iron brace. The screw and handle used was an old set from a coal-conveyor chain-tightening device.

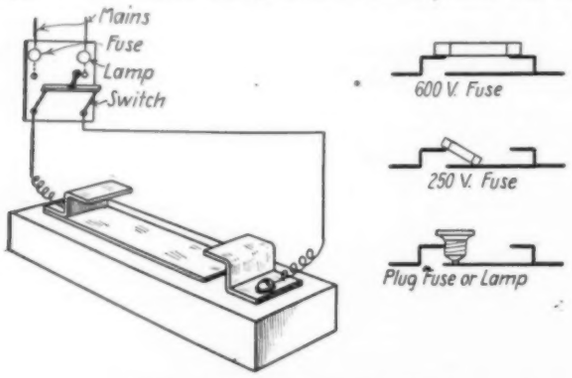
To use this, I insert the screw into the bearing from the inside of the end shield and then put on the plate which will follow through the bearing housing. I block under the channel so as to raise it high enough to permit the bearing to come out when the screw is turned. It may be necessary to run the screw back once or twice, if it is not very long, and to readjust the blocking.

This tool can also be used to draw the lining in by merely reversing and repeating the operation from the other side.

Combination Fuse and Lamp Testing Block.

By Herbert A. Fiske.

The accompanying sketch shows an arrangement suitable for testing 600-volt cartridge fuses, smaller cartridge fuses (for 250 volts), plug fuses and incandescent lamps, all on the same block, which was made from an old large-sized link-fuse block with the addition of a strip of metal under one of the clips. I use a 40-watt lamp as an indicator which will burn



Block for Testing Fuses or Lamps.

dim when trying out another good 40-watt lamp of the same voltage, and bright when trying fuses and larger lamps, such as 250 watt. If desired, a lamp of the largest size in the plant could be used and then the lamp tested would burn fairly bright, if still good.

Electrical Installation in an Up-to-Date High School.

What is said to be one of the most up-to-date school buildings in the state of Pennsylvania is now being erected at Lancaster, Pa. It is the new Boys' High School, in which an exceptionally complete electrical equipment is being installed by the electrical contracting firm of Hamilton Electric Company, Incorporated, 357 Third Street, Brooklyn, N. Y.

An especially interesting feature of this installation is the method of lighting the main auditorium of the school. This large room will have a leaded-glass ceiling with carefully selected attractive diffusing lamps. The lamps will be installed above the ceiling, each lamp being provided with a specially designed "Sunlight" reflector to throw the light downward. In this manner there will be produced an unusually even distribution of the light throughout the auditorium, this being attained with practically no shadows and giving an estimated illumination intensity on the floor of close to 5.5 foot-candles.

The stage lighting will consist of a modern equipment of footlights, side and proscenium lights. These will be controlled by a main switch, 12 branch-circuit switches and a complete set of Cutler-Hammer theater dimmers. There will also be considerable power wiring for the shops and laboratories, and wiring for lighting the entire establishment. A complete electric program signaling and clock system is being provided; this will be controlled by a master clock.

Regulation of Service Connections in Chattanooga.

An interesting wiring regulation has been issued by Chattanooga, Tenn., authorities, who rule as follows, instructing the patrolmen to watch for violations:

"All parties doing electrical work, connecting wires for lighting a building or telephone wires, must carry the wires to the top of the building for connection, except when connecting to a tall building; then they must be kept on a level, or above the level, with the top of the telephone pole or pole supporting the wire."

Among the Contractors.

Robert W. Johannis, formerly a member of the firm of Johannis & Abrams has recently opened a new electrical contracting office at 311 East Forty-seventh Street, Chicago, Ill.

The United Electric Construction Company, 1727 Sansom Street, Philadelphia, Pa., has been awarded a contract for electrical work and equipment in the new building to be erected by the Ogontz School for Girls, Ogontz, at $10,000.

Unusual demand for electric motors of all sizes is reported by L. A. Fleury-Electric, contractor and dealer in electric supplies, Indianapolis, Ind. In the last three months the Fleury-Electric has supplied more motors and handled more wiring installations for motors than in any other equal period in its history of 20 years.

The McDaniel & Campbell Company, of Springfield, O., was incorporated on February 1 for $25,000. It is taking over the McDaniel Electric & Mantel Company, which has been conducting an electrical contracting and mantel business. The new firm will do a wholesale as well as a retail business. The Messrs. Campbell were with the Avery-Loeb Electric Company, of Columbus, O.

The Fowler Electrical Supply Company of Toledo, O., has secured the contract for furnishing the electrical equipment, consisting of a motor and interlocking system, for the new United States searchlight tower now under construction at Fort Hancock. This concern is also motorizing the old hand-operated bridge at Thirty-second Street, in Cleveland, O., and is at work on the plans for a new bridge at Westport, Conn. The company has specialized on electrical installations for bridges for about 15 years.

DOLLAR WIRING KINKS

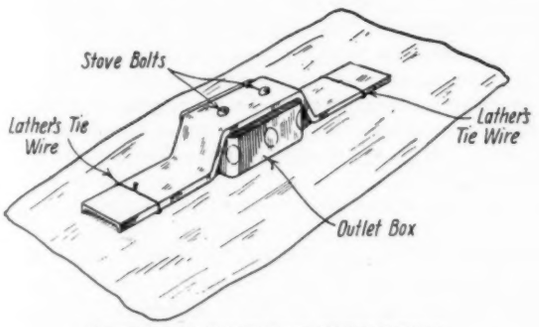
All readers are invited to contribute to this department. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; if a diagram is necessary, a rough pencil drawing will serve. The idea itself must be new and bright. A dollar will be sent to the contributor upon publication.

Pulling Wire Into Fixture Arms.

A very easy way to pull lamp cord or fixture wire into fixtures or desk or portable lamps, especially where the holes for the wire to pass through are very small, is as follows: Push the braid back onto the wire about one and a half inches. Cut the wire and rubber insulation off at that point and then pull the braid forward again. Now make a loop in the fish wire and put the sleeve through the loop, then twist the fish wire first around itself and later around the braid. The wire can now be pulled in very easily. No. 18 is a very good size for a fish wire. On desk lamps or portables, if lamp cord is used in a narrow stem, untwist the cord as far back as is necessary to go into the stem. H. Nickels.

Outlet-Box Holder for Metal Ceilings.

A simple outlet-box holder and brace for use on metal ceilings can be made by taking a short piece of strip iron, such as is used for tying the metal lath to, and bending in it an offset of about two inches, just enough to clear the box. Next punch two holes through it with the metal lather's punch and put two short stove bolts through the



Mounting Outlet Box on Metal Ceiling.

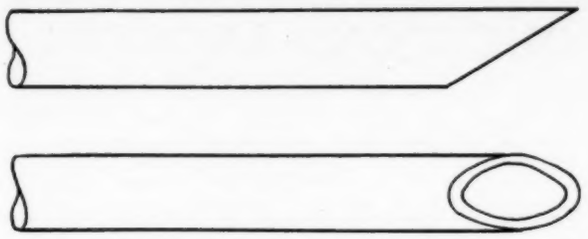
strip, and also through the holes already punched in the bottom of the box. After this is done, tie the strip to the metal ceiling with wire, thus making a good, solid brace for the fixture. Walter Morris.

Removing Heat Tarnish from Copper Bars for Panels.

When heating copper bars that are to be soldered in switchboard or panel work, many times the bar becomes overheated unintentionally, showing up in a dull grayish blue color after the bar is cooled off. By making two or three applications of soldering acid directly to the spot, and rubbing firmly, the bar may be restored to its natural color. The acid removes the discoloring and leaves the bar clean and bright. This is a better and quicker method than using emery cloth or sand paper to brighten the bar, as it does not leave a scratched spot as when using sand paper. On particular work the entire bar would have to be sand papered so as to have the same finish throughout. Harry B. Stillman.

Emergency Drill for Drilling Brick Walls.

In case of an emergency, when one wishes to drill a hole through a brick wall and there is no standard brick drill



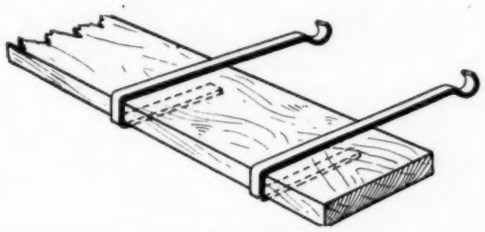
Using Conduit for Drilling Brick.

at hand, a piece of conduit cut off on the bias as shown in the accompanying sketch is very serviceable for one-half-inch and three-quarter-inch conduit.

R. R. Knoerr.

Simple and Handy Armature Support.

A handy armature-supporting arm for a small repair shop, where there is very little room on the bench, can be made as follows: Take a piece of one and one-half by one-half-inch iron and bend in it a loop long enough to hook over the back of the bench. Next cut it off about 14 inches from the front of the bench and then form a



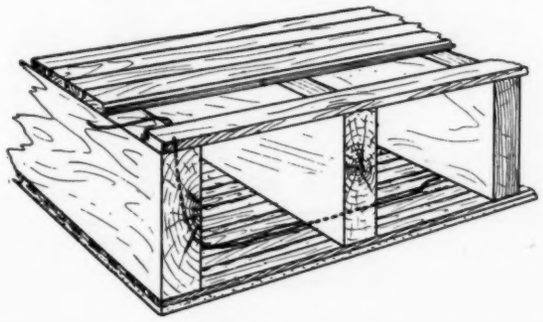
Armature-Supporting Bars.

hook on the front end to hold the armature shaft. Make two bars like this. They are complete, requiring no screws whatever for adjusting to various sizes. All that is required to adjust for different lengths of armatures is to slide one of the bars along the bench.

Walter Morris.

Fishing Under Floor Joists.

When fishing under floor joists and along furring strips I find that the work can be done considerably easier, by placing an offset near the end of the snake as per sketch. Push under the first joist, if the snake does not strike the opening under the next joist, turn the snake completely over as noted by dotted lines and by keeping a steady push



Fishing Under Joists.

on the snake while turning the end will slide under as soon as one-half turn has been made. Keep this up until the desired distance has been covered. The raised end of the snake keeps it above the uneven plaster or other obstructions while it is being advanced. C. W. Couch.

QUESTIONS-ANSWERS

All readers are invited to submit questions and answers to this department. Anonymous communications will not be considered. Questions may relate to electrical matters of any kind. Answers contributed by readers should be submitted preferably within eight days of the date of publication of the question and should be limited, if possible, to 300 words. Payment will be made for all answers accepted and published.

Questions.

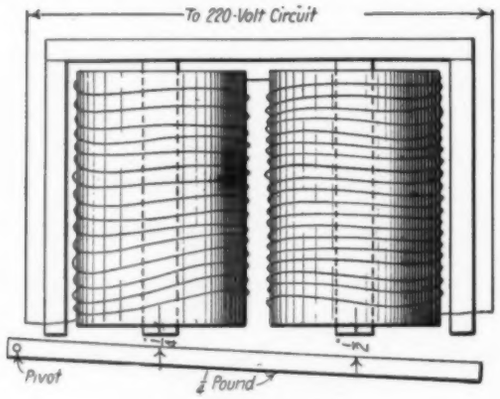
No. 381.—Ventilation of Flush Ceiling Fixtures.—Is it reasonable to insist on special ventilation upward in the case of a 100-watt fixture depressed flush in the ceiling? A series of these fixtures with glass bottoms is set into the ceiling under a balcony of a theater where there is limited headroom. There is a small ventilating clearance between the sides of the fixture and the frame for the glass bottom, but the inspector insists that a ventilating duct be run upward.—V. S. C., Buffalo, N. Y.

No. 382.—Lamp for Illuminating Lake Bottom.—We have a problem of trying to illuminate the bottom of a frozen lake for surveying the nature of the bottom before the ice breaks up, as certain work depending on this survey is to be undertaken at the earliest opportunity. The lake is 20 to 25 feet deep. It is proposed to use some kind of waterproof lamp connected by a cable to a storage battery, the lamp being lowered through holes punched in the ice at intervals. What kind of lamp, fittings and cable are suitable for this purpose? What size and voltage of lamp would be desirable?—F. G. T., Augusta, Me.

No. 383.—Overloading Motor-Driven Blower.—We have a 20-horsepower motor running at 3,600 revolutions per minute and direct-connected to a blower that furnishes 2,100 cubic feet of air at 1.5 pounds per square inch pressure. We find that the motor is overloaded by about 30 per cent. We cannot use a larger motor, as it has to sit on a base that is part of the blower frame. Would it be practical to install another blower so as to furnish air to the first one at a pressure of, say, 0.5 pound and thereby relieve the overloaded motor of part of its load?—H. D., Detroit, Mich.

Answers.

No. 380.—Design for Relay Coil.—I would like to secure data on the winding of a relay coil for use on a 220-volt direct-current circuit. The general arrangement of the coil is shown in the accompanying sketch. The coil must lift a one-fourth-pound armature through a distance of one-half inch at the further core and one-fourth inch at the nearer core. This lift must be made quickly as the relay is on signaling device. There is to be no current on this coil for more than a second at a time. What size of wire and how many turns should be used for each half of the coil? About what size of cores and yoke should be used?—R. S., Dayton, O.



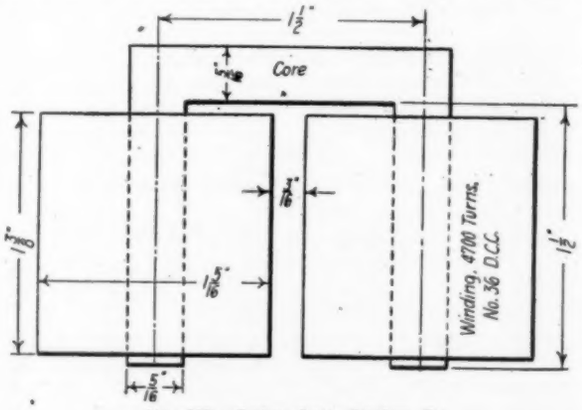
No. 380.—Relay Coil.

Answer A.—The simplest and easiest way to arrange the relay in question is to use for the relay winding a low-voltage coil, in series with which is connected a resistance to control the current and keep it from being too great for the winding. This is the standard practice adopted by instrument makers for apparatus requiring only a small amount of current, and in this case, will permit using a comparatively small amount of wire. A set of coils designed to be connected directly across the 220-volt circuit would have to have a much greater amount of wire to give the necessary resistance to keep the current at the low value to be used. The electromagnets from an ordinary three-ohm, two-cell battery door bell, in series with which is connected an incandescent lamp or lamps for resistance, should operate the relay.

Computations based upon established laws of the magnetic circuit, show that about 335 ampere-turns are required on the magnet to operate the armature of the relay. The ordinary bell coils are wound with about 475 to 500 turns of No. 24 wire for the two. Therefore these would require about 0.68 ampere to do the work. Two 220-volt lamps, one 100 watts, the other 50 watts, or one 150-watt lamp, connected in series with the bell coils, would allow this current to flow and give them the required strength, as nearly as can be estimated from the data given. Or two 75 or 100-watt, 110-volt lamps connected in series and these in series with the relay, would also do the work. It may be that less current than that estimated would do, in which case smaller lamps can be used. If Mazda lamps are used for the resistance, these will have the effect, at the instant contact is made, of giving a heavier than normal current through the relay until the filaments heat up, thus insuring quick action.

Answer B.—No. 36 wire is about the smallest size wire practical to use for the winding of the relay coils, and carry the current. To give the resistance necessary to limit the current to an allowable value, 2,550 feet of this size wire will be required. This can be wound in two coils on the two branches of a horseshoe core, each coil 1.375 inches long, and the core 0.375 inch square, giving about 4,700 turns per coil. With a maximum current of 0.2 ampere, which the coils will stand for the three seconds they are to be in service, and which is the current which will flow with this resistance at 220 volts, the ampere-turns will be more than ample to give the magnetizing force required to lift the relay armature. It is thus seen that the design is governed by the minimum amount of wire which can be used to give the required resistance at 220 volts, rather than by the number of ampere-turns required for the magnetic action.

From the above considerations, then, the coils could be made as follows: Core, 0.3125 inch square in cross-section, horseshoe in shape, with each branch about 1.5 inches long (or long enough to accommodate the winding) and yoke or bridge 1.5 inches center to center of the branches. Core to be made of soft annealed iron, preferably laminated, and cross-section may be round and of equivalent area, approximately, if desired. Coils, two, each wound with 1,275 feet of No. 36 double-cotton-covered magnet wire with the windings 1.375 inches long, and 1.3215 inches square on the outside. These coils are to be connected in series. Each coil would have 4,700 turns.—F. E. A., Fort Collins, Colo.



No. 380.—Relay Coil—Design B.

NEW APPLIANCES

A Review of the Latest Developments and Information Respecting Electrical and Kindred Mechanical Appliances

New Three-Pound Westinghouse Flatiron.

Dealers in popular electrical heating appliances are beginning to realize that there is a constantly increasing demand for an electric iron smaller in size than the one usually supplied for domestic and laundry use. Smaller-sized irons are more convenient for light pressing and for use in the sewing room, and are considered as absolute necessities by many travelers for the proper maintenance of their garments. There is a great demand for them also for occasional ironing where there are only a few pieces to be done.

New Three-Pound Electric Flatiron.

To meet this demand a new three-pound electric iron has recently been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Although designed especially for the use of travelers, it is convenient for all kinds of light pressing. The handle is not removable, as in the former model, thus avoiding the danger of losing or misplacing it, while the space required for packing is no greater. The cord is permanently attached and a hole in the stand provides a receptacle for heating a curling iron.

All of the desirable features of the larger six-pound irons are found in this smaller size, including simple construction, guaranteed heating element, and no heat radiation from the upper surface. All heat is given off at the ironing face, which permits an even temperature to be maintained with no part hotter than another. A heat-storage plate absorbs all heat not needed to keep the ironing face hot. This means economical operation and long ironing periods without excessive use of current.

The weight is accurately balanced and the handle is especially designed for the comfort of the hand. The iron is supplied with a fireproof stand, flexible cord and attachment plug.

Jewel Electric Outboard Motor.

The electric motor boat has always met with favor on account of its noiseless working and cleanliness. In view of the success that the outboard motor has met, it is not surprising that an electric outboard motor has recently been placed on the market.

This outfit, which is illustrated herewith, is manufactured by the Jewel Electric Company, 112 North Fifth Avenue, Chicago, Ill. The machine is of particular use in cases where simplicity of operation is desired, while for duck hunting or trolling a boat fitted with one of these little motors would be almost ideal. As regards general layout, the machine closely resembles the conventional type of gasoline-driven outboard motor, being clamped to the boat in the usual manner.

The motor is placed directly above the main driving shaft, which is contained in a telescopic tube, allowing the propeller to be adjusted to the correct distance beneath the surface of the water. The propeller is driven through a modified type of worm gearing, which gives great speed reduction between the motor and the propeller, this being necessary, owing to the fact that the normal speed of the motor is about 3,000 revolutions per minute. Above the motor is a small steering wheel, which enables the propeller to be turned to the right or left hand, or completely around, if it is desired to reverse the direction of the boat. To this wheel may be fitted either a tiller or steering yoke, according to requirements. The outfit is made of aluminum and manganese alloy wherever possible, the idea being to reduce the weight to a minimum. The motor complete, but without battery, weighs only 50 pounds.

The armature of the motor runs on ball bearings, and the commutator and brushes are of special design, suitable for low voltages, as the motor is used with a storage battery of 6 to 12 volts. By means of a simple device the motor may be detached from the driving shaft and used for other purposes where power is required, the current being derived from the batteries in the boat. The standard storage batteries supplied with the regular equipment are two batteries of six volts, 120 ampere-hours each, but the

Electric Outboard Motor Being Applied to Boat.

Jewel Electric Company can supply a range of accumulators of 6 to 12 volts, having a varying capacity of 60 to 120 ampere-hours.

The Burn-Boston Carbon Ground Cone.

The increasing requirement of thorough grounding of transformer secondaries, neutral conductors, etc., is causing much attention to be directed to the most reliable methods of making a satisfactory ground connection. The ideal ground, a water pipe, is not always available. Driven-

pipe grounds and several other methods of grounding used in the absence of convenient water pipes have frequently been found to be unreliable. A grounding device that has been developed to overcome these difficulties is illustrated herewith.

It consists of a solid, non-porous carbon electrode, 1.5 inches in diameter and 23 inches long, which is surrounded by a carbonaceous mix that is porous and moisture-absorbing. This mix is closely packed around the carbon core, thus producing a conductor of but 0.05 ohm resistance. The upper portion of the outfit is conical so as to cause the tamped earth to pack closely against it. On top of the carbon electrode is a copper lug connection sealed in a waterproof compound so as to leave a well timed copper lug exposed for ready connection to a No. 4 ground wire, perferably stranded and rubber-insulated. The entire device is only five inches in diameter and 28.5 inches long and is easily installed.

Burn-Boston Carbon Ground Cone.

Advantages claimed for this ground cone are: Permanency due to absence of exposed metal and therefore freedom from electrolysis or other corrosion; very low resistance, due to large surface and hygroscopic character of ground body; ease of installation; low cost.

The Burn-Boston ground device is marketed by Hickey & Schneider, 61 Broadway, New York City.

New Tree Trimmers for Line Construction Work.

The construction and maintenance of overhead pole lines will again be resumed in the near future, which makes it timely to consider equipment that will facilitate this work. In all work of this nature it is well known that the overhead conductors themselves must be kept free from branches of trees adjoining the line. To do this various types of tree trimmers have been used by which the overhanging branches are trimmed so as to leave the line perfectly clear.

In the accompanying illustrations are shown two new tools of this character, of which Fig. 1 shows what is known as the "Ideal" tree trimmer. This is a light-weight but substantial tree-pruning device which is arranged so that a saw blade can be readily attached to the head by means of two set screws that are provided with the saw, and by which the saw can be easily removed if it is not needed. Such saws are found very convenient where branches of considerable thickness have to be dealt with. Where slender branches are met the knife provided in the tool is used. It has a forged tool-steel blade which is carefully tempered and ground to a keen edge. A steel spring holds and returns the knife to the open position and the blade is operated by means of a crank with a hole at the end for fastening an operating cord. The socket of this tool is arranged to receive a one-inch handle of whatever length is desired; this is provided by the purchaser himself.

Another form of tree trimmer, known as the "Prunax," is shown in Fig. 2. This tool is provided with an eight-foot handle to which a ten-foot extension can be readily added. This is a practical tool for pruning and trimming trees. It has a shear head made of steel that extends down 12 inches on both sides of the handle to which it is securely riveted. The handle is 1⅛ inches square. The knife blade is of tool steel properly ground and tempered to a sharp edge and operates between two parallel blades of steel that are curved to hook over the branch that is to be cut. The actuating lever is controlled by a spiral spring that returns the knife to the open position and carries a clevis at the end to which an operating rope may be attached when the extension handle is used with the trimmer. Ordinarily this acts as an operating handle.

Fig. 1.—"Ideal" Tree Trimmer.

Fig. 2.—"Prunax" Tree-trimming Outfit.

Both of these tools, while especially useful for line-construction and maintenance gangs, are likewise of general utility in orchards, parks, etc. They are made by Mathias Klein & Sons, 562 West Van Burean Street, Chicago.

Isko—An Electric Self-Contained Domestic Refrigerating Outfit.

The present prolonged spell of frigid weather naturally brings up longings for the good old summer time. With the latter, however, will come again its old problems of keeping comfortable, cool and sanitary, not only our persons and surroundings, but also perishable foods. In the solution of these problems electricity is taking a rapidly increasing part through the steadily growing use of electric fans, of electrical and therefore comfortable methods of doing whatever cooking is necessary, and now even of electrical and automatic refrigeration of household food supplies.

The very unreliable and frequently insanitary way in

which foods are preserved in the ordinary ice chest, also the annoyances connected with the visits of the iceman, the clogging of drain pipes, etc., have turned refrigerating experts to efforts at development of household refrigerating

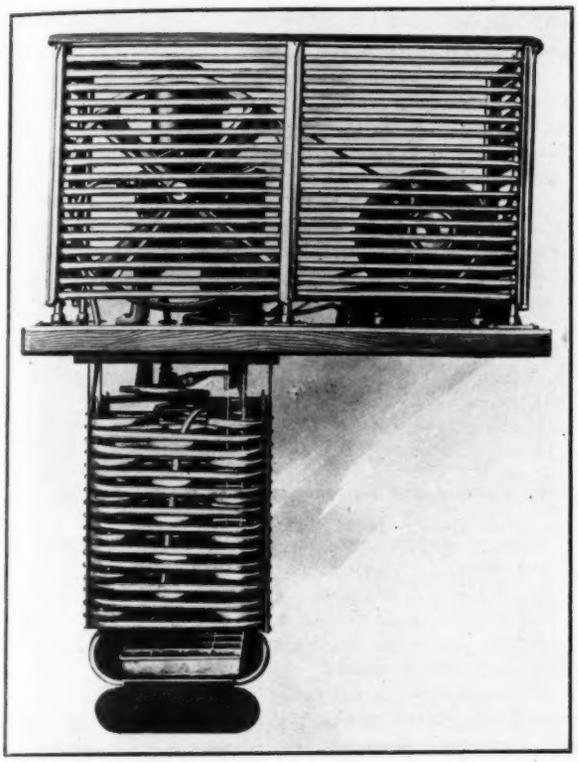


Fig. 1.—Isko Refrigerating Unit Ready for Installation.

machines that would entirely eliminate dependence on outside supply of ice. Various outfits have been brought out, which usually are expensive and complicated stationary equipments or have other disadvantages for use in the home. These difficulties it is believed are overcome in the automatic and self-contained electric refrigerating unit manufactured by Isko, Incorporated, 1735 Mount Elliott Avenue, Detroit, Mich.

In Fig. 1 is shown a complete Isko unit ready to install in almost any refrigerator, new or old. Fig. 2 shows the outfit applied to a standard ice box of 200 pounds ice capacity. All that is required to install it is to cut a hole 13 inches square through the top of the ice compartment to receive the lower coil, which becomes the refrigerating medium in place of the ice. No water or drain connections are necessary. The small electric motor used for driving the compressor at the top needs merely to be connected to any convenient circuit outlet.

Isko works on a very simple principle. The unit consists of a sealed system of tubing containing a refrigerating gas easily liquefied at low pressure. The tubing at the top of the refrigerator is the condenser coil, with which is associated the motor-driven compressor. The tubing in the ice chamber is the expansion or refrigerating coil. An automatic valve allows some of the condensed liquid to escape from the upper into the lower coil, where its rapid expansion to the lower pressure converts it into a gas and causes it to absorb heat from the walls of this coil. Air circulating within the refrigerator and passing over this chilled coil keeps the entire refrigerator cold. The compressor takes the gas from the expansion coil and again liquefies it, after which it passes into the coil at the top where it gives up to the open air the heat developed by the compression. This cycle is continually repeated and is under the control of an automatic thermostat that can be set to keep the refrigerating chamber at any suitable temperature. This thermostat in turn governs the motor switch, starting and stopping the compressor as needed.

The usual temperatures found desirable and economical range from 43 to 46 degrees Fahrenheit; the adjustment can be set to maintain temperatures 10 to 20 degrees below this, if desired. The tubing used in the outfit is made of tinned copper and is hermetically sealed, so as to be proof against corrosion or leakage. The condensing coil at the top forms a cage protecting the compressor.

Just below the expansion or refrigerating coil is a small compartment containing a pan in which cubes of ice for table use may be frozen from any pure, mineral or distilled water. The refrigerating chambers will easily keep all food in wholesome condition indefinitely. Ice cream may be kept frozen a day or more, something that cannot be done in any ice box because the temperatures attained in the latter are not low enough. It is reported that a hunter residing in Toledo, O., recently kept two dozen wild ducks for five weeks in an Isko-equipped refrigerator; the birds were frozen solid and kept in as perfect condition as in a modern cold-storage warehouse.

The Isko equipment is not only entirely automatic, simple, quiet and absolutely sanitary in operation, but is quite economical of energy consumption. It is said that its cost for electricity is considerably lower per month than the cost of ice. Its economy and many other advantages over using ice are therefore a clear offset to its first cost, which is quite moderate. Several prominent central-station companies have undertaken to encourage the installation of Isko units on a liberal scale, the cost of the outfit being spread over a period of 12 or more months. As a central-station load, this refrigerating set is especially desirable because the current consumption is highest in summer and smallest in winter, thus tending to improve the load-factor materially.

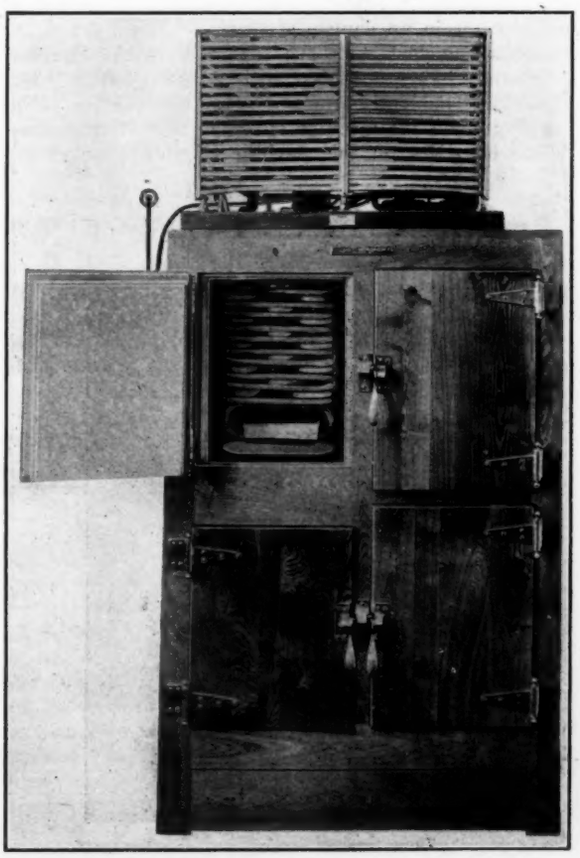


Fig. 2.—Isko Installed in an Ordinary Household Refrigerator.

New Westinghouse Sewing-Machine Motor.

The sewing machine was one of the first household appliances to be equipped with an electric motor. The first motors employed were just the ordinary type, but later designs have resulted in the development of a motor having necessary speed control, for use solely on sewing machines, and the efficiency and operating features of such motors have been greatly improved.

Most desirable features are to be found in what is known as the "Sew-Motor" shown in the accompanying illustrations, which has just been placed on the market by the Westinghouse Electric & Manufacturing Company.

The motor can be readily attached to any make of stationary or drop-head sewing machine, new or old, with the exception of a few obsolete models. When not in use, the motor, if mounted on a stationary-head machine, can be pushed back out of the way and the cover put on, or dropped from the head, if used on modern types of drop-head machines. When desired, however, the motor can be removed readily by loosening one thumb screw, as it is light and portable.

The outfit, which is compact and extremely neat in appearance, consists of a small motor (which operates on either alternating or direct current) mounted on a nickel-plated base, a speed regulator with operating chain and 10 feet of cord and plug and a round leather belt. The weight, including the regulator, is only seven pounds. The speed regulator is slipped on the treadle and held by a spring, making the mounting exceedingly simple. The operating chain is attached to the metal framework directly above the controller and pulled taut.

The operator can sit in a natural and comfortable position facing the needle instead of in a sidewise position which would be necessary were the regulator separate from the machine and placed in front or to one side. Aside from those previously mentioned, it is said that there are other advantages in having it so mounted. It is out of the way and is in no danger of being broken. When the operator has finished her work she folds up the machine, and does not have to bother with any auxiliaries. The regulator is permanently attached to the machine and is out of the way when the machine is folded up. Furthermore, there are no wires on the machine offering a possibility of tripping the operator.

Fig. 1.—New Westinghouse "Sew-Motor" in Use.

The regulator is light and substantial. The case is made of pressed steel and the principle of operation is entirely new. There are two coils in series with the motor. When there is no pressure on the treadle the circuit is open. With a slight pressure on the treadle a contact is made, both

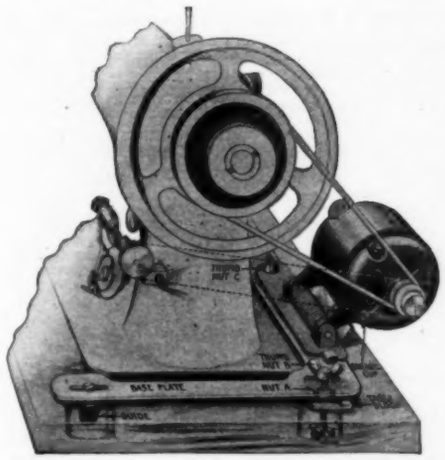


Fig. 2.—Method of Applying Motor to Sewing Machine.

coils being in series, and as a greater pressure is applied the resistance is cut out turn by turn. By varying the pressure the speed is varied so that one stitch, or several hundred stitches a minute can be taken. There are approximately 100 steps in the controller, giving a corresponding number of speeds.

The "Sew-Motor" is driven by a belt. While the motor fastens firmly to the machine, it is extremely simple to attach. There are no rubber feet to hold it in place and in time to become hard and slip, and no cork pulleys to become smooth and crack. No tools of any kind are needed. To attach the motor, the belt is removed and the small bolt shown in back is put through the rear belt hole. Nut *A* shown in Fig. 2 is then tightened, and the nickel-plated base placed over the belt hole. Thumb nut *B* is then tightened, and the motor is in place, being held firmly by one thumb nut. The small belt furnished is next placed in position as shown. When it is desired to wind the bobbin, the belt is slipped off the handwheel and onto the bobbin wheel. A helical spring tends to force the motor away from the head of the machine and so always keeps the belt tightened, thus avoiding the annoyances due to belt slippage, etc.

When folding up the machine it is only necessary to loosen the belt, disconnect the plug, and swing the motor around under the head. Two hooks are furnished for screwing into the back of the machine so that the cord from the lamp socket can be wound upon them. Felt pads underneath the base prevent the motor from scratching the finish of the machine.

The motor itself is out of the way when operating. This leaves both sides of the machine table clear so that the operator can use this space for sewing material. Being driven by a belt, a great deal of the noise occasioned by friction drive is eliminated, and the design of the motor is such as to give extremely quiet operation. Belt drive also causes less wear of the bearings of the machine, it is claimed.

The motor is lubricated with a grease cup which eliminates the danger of oil running out on the work. Even when dropped with the head of the machine there is no danger of oil spilling. Being permanently attached to the machine, the motor does not depend on its weight alone to hold it in place. There is no danger, therefore, of its slipping out of place, and being a constant source of worry to the operator.

New York Tribune Institute Passes on C-H Electric Combination Table Stoves.

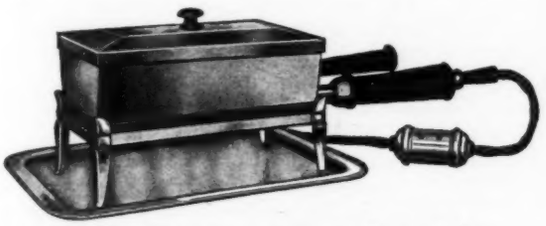
The *New York Tribune* conducts a testing laboratory where thorough tests are made of articles for the household. Electric appliances are among these articles and when the seal "Tested and Endorsed by the Tribune Institute" is given an appliance, the materials and construction and its ability to perform satisfactorily the service for which it is intended are guaranteed. The C-H electric combination table stove made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has been tested and endorsed by this Institute and here is what the *Tribune* says about this appliance:

"With this versatile little appliance you can sit at the table and cook an entire meal with the current from an ordinary lamp socket. In one small oblong stand, on four slim little legs, you have a frying pan, griddle, toaster, broiler, saucepan and small oven.

"If anything is to be boiled, the heater is placed under the pan. For broiling or frying the heater goes on top of the pan. The griddle and toaster are, of course, placed directly over the heater. A flexible cord with a three-heat switch is connected with the ebonized wooden handle of the heater, so that the temperature is always under control and can be maintained, raised or lowered at will.

"With this table stove one can sit at breakfast and make griddle cakes fresh and hot as they are needed, fry or poach eggs, toast bread, broil chops or a small steak, cook some casserole delicacy or turn the water pan into a little oven that will keep food warm for some tardy member of the family.

"The cost of operation varies from two to six cents per hour."



C-H Combination Table Stove Ready for Boiling.

The report of the New York Tribune Laboratory is given in part below.

"Construction.—Very good.

The Cutler-Hammer electric table stove consists of a steel stand, and a rectangular deep water pan with cover, all nickel-plated finish. The heater consists of two steel plates welded together and inclosing between them the heating element. The water pan and heater are provided with ebonized wooden handles and the latter contains the terminals of the heating element. Additional accessories furnished with this stove are a toasting screen and a broiling screen. The device is equipped with six feet of flexible connection cord and a C-H feed-through three-heat switch. A tray upon which to rest the stove during use is also included.

"Efficiency of Design and Operation.—Very good.

This stove is attractive in appearance and well constructed. It is designed for use on a dining table and will toast, fry, broil, steam or boil.

"One side of the heater serves as a frying pan, while the other side is a griddle or hot plate. When used for boiling or steaming, the water pan is placed on top of the heater and the food cooked directly in the pan or in a dish immersed in the hot water. The latter operation would, of course, be slower.

"Inverting the water pan over the heater forms an oven, while placing the heater over this pan permits chops and steaks placed therein to be broiled. Toasting can be done by putting the wire screen on top of the heater.

"This appliance affords a very complete outfit and the three-heat feed-through switch is a convenience, since it not only gives control of the temperature but assists in preventing the use of unnecessary current.

"Another noteworthy feature is that the entire device can be immersed in water for cleaning and even the heating element can be washed or used as an immersion water heater, if care is taken not to wet the handle.

"Operating Cost (Power or Fuel Units).—Medium.

On 110-volt, 60-cycle alternating-current lighting circuit. High heat—595 watts. Medium heat—405 watts. Low heat—205 watts."

"Wiremold" Attracts Favorable Attention.

The American Conduit Manufacturing Company, Pittsburgh, Pa., has recently developed a new form of wiring material with a full line of fittings, and established this product on a commercial basis under the trade name of "Wiremold." An illustrated description of Wiremold and fittings for its use was published in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of September 2, 1916.

Attention has been called to the fact that under the present rules of the National Electrical Code, or any existing standards of the Underwriters' Laboratories, Inc., there are two points which would prevent the recognition of this material. One, "Wiremold" does not comply with present standards for rigid conduit either in shape, weight, or method of installation. Two, "Wiremold" does not comply with present standards for metal molding in that it is not so constructed as to form an open raceway to be closed by a capping after the wires are laid in. It is intended that the wires be fished in.

In a statement to M. B. Austin & Company, Chicago, Ill., distributors for the manufacturers, D. Hayes Murphy, president and treasurer of the American Conduit Manufacturing Company, states that under date of October 19, 1916, Dana Pierce, vice-president of the Underwriters' Laboratories, Inc., addressed a communication to Charles E. Dustin, general secretary of the Associated Manufacturers of Electrical Supplies, calling attention to the fact that this new form of wiring material had been submitted to the Underwriters' Laboratories. The interior-conduit manufacturers of the Association were invited to express an opinion regarding this product, with special reference to the question of the desirability of so adding to or modifying the existing standards as to provide a means of recognizing this material, or others of a similar character and use. A meeting of the Interior Conduit Section was held on December 20, 1916, at which time the matter was referred to the Metal Molding Committee. This committee met with representatives of the Underwriters' Laboratories on January 12, 1917. The committee was unable to come to any conclusion, and it was agreed to hold a meeting of the entire Interior Conduit Section, consisting of manufacturers of rigid conduit, non-metallic flexible conduit, metallic flexible conduit, armored conductor and metal molding. This meeting was held on January 30, at Pittsburgh, Pa., and a motion was passed directing Mr. Dustin to reply to the communication from the Underwriters' Laboratories, Inc., that in the opinion of the members of the Interior Conduit Section it is desirable to so amplify or modify existing standards as to provide a means of recognizing material of this character and use, providing such material measures up to the Underwriters' Laboratories ideas of safety to life and property, and providing that the material is of a distinctive shape or construction.

H. B. Kirkland, vice-president of the company, states that within the year he has traveled across the country exhibiting "Wiremold" to inspectors and contractors, and has not discovered adverse criticism of the material, its properties or its detail in construction. He says that the product is being well received, and that contractors who have used the material are emphatic in their praise of its excellent features.

ACTIVITIES IN THE TRADE

The American Manufacturers' Agency, Inc., Harris Trust Building, Chicago, Ill., has taken the agency for soldering paste, manufactured by the Sieffert Electric Company, Evansville, Ind., and is introducing it to jobbers and dealers.

Gamewell Fire Alarm Telegraph Company, Newton Upper Falls, Mass., was the lowest bidder and was awarded the contracts for 1,250 fire-alarm boxes of non-interference, succession type, by the Fire Department of New York City.

Allen & Garcia Company, consulting and constructing engineers, McCormick Building, Chicago, have announced the establishment of a power department which is in charge of C. M. Garland. The electrical work, as at present, is in charge of W. C. Adams.

The Trumbull Electric Manufacturing Company, Plainville, Conn., has just issued its monthly publication "Monthly Cheer." It contains many short notes of interest and also a description, with illustrations, prices and detailed data regarding combination switches in safety boxes and motor starting switches.

Steam and Electrical Machinery Company has opened offices in the Ridotto Block, Bay City, Mich. The company will represent manufacturers producing both steam and electrical machinery and supplies. H. W. Brooks is president J. C. Hewitt vice-president and F. F. Hewitt, secretary-treasurer.

P. & B. Manufacturing Company's Plant Destroyed.—The company's plant at Milwaukee, Wis., was destroyed by fire on February 5 and the loss estimated at $35,000. Arrangements are now being made to build a new plant. It will be 80 by 300 feet and it is expected that the plant will be in operation within a couple of months.

Barber-James-Dwinnell Electric & Manufacturing Company, Kansas City, Kan., is going to change its location in the very near future to Topeka, Kan. The company makes electrical supplies and storage batteries. P. L. Dwinnell, secretary-treasurer, states that the new factory will provide about 12,000 square feet of floor space.

Benjamin Electric Manufacturing Company, Chicago, will celebrate Washington's birthday at its plant so that all employees may attend, on February 21. Bernard J. Cigrand, of the faculty of the University of Illinois, will give an address, "Washington and the Flag." He is from Batavia, Ill., and has written illustrated stories on Colonial times, revolutionary patriotism, etc., and is well fitted to deliver the address.

Westinghouse Lamp Company, 165 Broadway, New York, has awarded a contract to the Stone & Webster Engineering Corporation, Boston, for the erection of its new lamp works on property recently acquired on Pennington Avenue, Trenton, N. J. The plant will be four stories, about 80 by 500 feet, providing a floor area of 200,000 square feet. The plant will have a capacity of about 50,000 lamps daily. The estimated cost is $1,000,000.

Sangamo Electric Company, Springfield, Ill., has issued bulletin No. 45, devoted to Sangamo ampere-hour meters. This bulletin deals with the latest types of these instruments and is very completely illustrated. Detailed description is given of the construction of these instruments and of their essential parts, accompanied by discussion of their use and characteristics for various classes of service, such as car lighting, vehicle service, wireless stations, submarine boats, telephone exchanges, etc.

Annual Meeting of Trumbull Electric Manufacturing Company.—The meeting was held at Plainville, Conn., on February 6, the directors meeting with the stockholders and presenting their reports. The following officers were elected: President, John H. Trumbull; vice-president, Frank T. Wheeler; secretary and treasurer, Henry Trumbull.

Westinghouse Church Kerr & Company, engineers and constructors, 37 Wall Street, New York have just issued a folder describing the large electrical power plant on East River in Long Island City, which was constructed a few years ago by the company. The folder is gotten up in an attractive manner and the illustrations are in colors. The plant furnishes the power for propelling the Pennsylvania and Long Island railroad trains through the Hudson River and East River tubes.

The Strauss Transit System, Incorporated, 185 Jefferson Avenue East, Detroit, Mich., has issued a well illustrated prospectus on the Strauss inverted elevated-railway system. This is a system devised by J. B. Strauss, president and engineer of the Strauss Bascule Bridge Company, the designer of the bascule, or commonly known jack-knife, lift bridge. A distinctive feature of this new elevated system is that the cars are suspended from standard narrow-gauge trucks that are mounted on two rails in such a manner that should the trucks or connection between car and truck fail the car cannot drop to the ground. A number of distinctive advantages are claimed for this system.

National Carbon Company, Cleveland, O., has recently issued interesting folders on arc lights. The first of these folders speaks of a new carbon for arc lights called "Silvertip." Views are reproduced of the carbons in use. These show the negative carbon as less than half the diameter of the positive carbon and it is stated that when the arc is struck the positive carbon quickly burns to a point and being of such a small diameter there is no tendency to wander and cause a fluctuation in the intensity of the light. The second folder deals with arc lights used in blue-printing machines. In connection with this review Columbia carbons, for white-flame and inclosed arc lights, are mentioned.

Diehl Manufacturing Company, Elizabeth, N. J., gives an interesting description of its dynamometer, and the things for which it can be used, in a recently issued bulletin No. 508. The energy absorbed or developed by any rotating machine may be obtained by means of the dynamometer without reference to any electrical instrument or connections. The machine is simply a motor and generator swinging free in a trunnion. The electricity generated in the armature magnetically causes the frame to follow the direction of rotation. This pull is recorded by scales and a tachometer reading gives the speed and from these the horsepower is computed readily. Many good illustrations are shown of applications of the dynamometer.

Metropolitan Engineering Company, 35 Vestry Street, New York, has just issued a booklet entitled "Data for Central Station Engineers." It is gotten up in a very comprehensive manner and will be found of considerable value to all central-station engineers. The contents is well indexed so that any item in the booklet may readily be found. The first question dealt with is "The Non-Protected System." In considering this kind of a system, many ways are described by which the consumer can and does get current free of charge. Things in such a system are also

spoken of which make the maintenance cost higher than what it should be. It is then shown how these faults, which are a great source of loss to the operating company, may be eliminated by using "The Protected Service." The maintenance cost is reduced and the consumer cannot tamper with the service wires so as to defraud the operator. The meters, fuse boxes, etc., in this latter system are all sealed. The system is designed so that mischievous persons cannot tamper with or interrupt the consumer's supply and the meters can be readily tested at any time without disturbing any connections. All live contacts are protected so that it is impossible to tap the service wires ahead of the meter. Briefly, this system gives the operator absolute control of his system. On other pages of the booklet many tables, of value in making electrical determinations, are given as well as line drawings and descriptions of various wiring installations.

Western Electric Company had its 1917 sales conference at the Mercantile Club, St. Louis, Mo., recently. The meeting was attended by general staff representatives, local salesmen and country salesmen. Several representatives of large electric and manufacturing plants from New York and Chicago also were present. The session opened with a preliminary meeting in the St. Louis office of the corporation, followed by the inspection of warehouse stocks and the new stock-maintenance system of the company. At noon the guests attended a luncheon in the Mercantile Club. E. A. Hawkins, telephone sales manager, addressed the men on the telephone policy and farm-lighting campaigns. He was followed by the opening discussions of E. P. McGrath. P. L. Thomson, advertising manager of the Western Electric Company of New York, spoke on advertising. The banquet of the Western Electric Company of Chicago was held February 15.

PERSONAL AND BIOGRAPHICAL

MR. SANGER B. STEEL has been elected a vice-president of J. G. White & Company, Inc., New York, and will have charge of the handling and distribution of securities.

MR. R. U. STEELQUIST, local manager of the Oregon Power Company at Dallas, Ore., has been elected vice-president of the Dallas Commercial Club.

MR. R. D. JENNISON has been appointed general manager of the Pennsylvania Utilities Company, succeeding Mr. W. D. Ray. Mr. Ray continues as vice-president of the company.

MR. NORMAN G. NICOLL has resigned as manager of the Rubes Electric Devices, Inc., Brooklyn, N. Y., to become manager of the Dixie Service Corporation.

MR. J. B. WILSON, new-business manager of the Meridian (Miss.) Light & Power Company, operated by Henry L. Doherty & Company, will be married to Miss Alice Louise Fyne, February 19, at St. Saviour's Church, in Brooklyn, N. Y.

MR. OLAF A. PETERSON, chief engineer at the Rockingham County Light & Power Company's plant at Portsmouth, N. H., was recently presented with a gift from employees of the plant, in appreciation of his good will and friendship.

MR. J. D. DOWNER, for the past 20 years a subscription representative of the WESTERN ELECTRICIAN and later of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN, has been appointed postmaster of Downers Grove, Ill., by President Wilson. Mr. Downer assumed his new duties on February 1.

MR. ROY BALLARD, auditor of the Ottumwa (Iowa) Railway & Light Company, has been appointed auditor of the Fort Smith Light & Traction Company, Fort Smith, Ark.

MR. DONALD McDONALD, manager of the Louisville Gas & Electric Company, has been appointed auditor of the Louisville Industrial Foundation, at the annual meeting of stockholders of that organization.

MR. W. H. HODGE, manager of the publicity department of H. M. Byllesby & Company, addressed the Louisville Jovian League on the subject of "Co-operation" at its annual meeting and banquet.

MR. N. McMANAMY, for the past three years in charge of the lamp department of the Electric Shop, which is owned by the Kansas City Light & Power Company, has recently been made manager of the establishment. He succeeds Miss Marie J. Russell, who was recently married to Robert Wright, of the B.-R. Electric Company.

MR. H. L. BEACH, general manager of the Utah Light & Traction Company, has tendered his resignation to accept a position in the East. The resignation was effective February 15. Mr. Beach's successor has not yet been named.

MR. A. E. WARD, formerly with the Reading Transit & Light Company at Reading, Pa., has been transferred, but is still in the employ of the same company. He is now located at Lebanon, Pa., as general manager of that division of the company's system.

MR. C. W. HUNTINGTON has succeeded Charles Hotchkiss as president of the Richmond Light & Railroad Company. His offices are in New York, N. Y., and besides holding the above office he is chairman of the board of the Virginian Railway.

MR. W. S. MURRAY, as assistant to the president of the Housatonic Power Company, now has charge of the power system, construction and other engineering work. The new arrangement went into effect recently and has been arranged so that Mr. Murray still remains active in the firm of McHenry & Murray.

MR. D. W. BLAKESLEE, formerly an electrical engineer with the Duquesne Light Company, Pittsburgh, Pa., is now assistant superintendent of the Penn Electrical & Manufacturing Company, Irwin, Pa.

MR. W. A. HOLLAND, JR., has left this country for Sao Paulo, Brazil, where he will instruct in the electrical engineering department of the Mackenzie College. Mr. Holland was formerly with the General Electric Company, Schenectady, N. Y.

J. C. PAYTON has recently been appointed secretary of the Chicago Utilities Company. This company has among its subsidiaries the Chicago Tunnel, the Illinois Telephone & Telegraph and the Chicago Warehouse & Terminal companies of Chicago.

MR. A. L. PIERCE, superintendent of the Wallingford (Conn.) municipal electric light plant, has been appointed a member of the committee on standardization of the International Association of Municipal Electricians.

MR. EDWARD M. GRAHAM, general manager of the Bangor Railway & Electric Company, recently addressed the Bangor (Me.) Chamber of Commerce. He described the various functions of his system, which serves eastern Maine with power, light and transportation.

DR. W. F. M. GOSS, for many years associated with the Schools of Engineering, Purdue University, and since 1907, dean of the College of Engineering of the University of Illinois, has resigned that office, effective March 1, 1917, to assume the presidency of the Railway Car Manufacturers' Association, an office to which he was elected on February 1, subject to his release by the University authorities. The association is of recent origin and will study problems of the industry as presented in the work of individual plants, such as cost accounting, welfare work, etc.

OBITUARY.

MR. E. P. JORDAN, 56 years old, one of the leading electrical contractors in Topeka, died recently at his home, 808 Lane Street, after a long illness. Mr. Jordan has been a resident of this city for over 25 years and has many friends among professional and business men. He came here as an employee of the St. Louis Construction Company, which had secured the contract for wiring the state hospital. After the work was completed, Mr. Jordan became construction foreman for the Edison company, a position which he held for seven years. He has been in the electrical business in Topeka continuously for the past 17 years.

CURRENT ELECTRICAL NEWS

Weekly Record of Construction Activities

EASTERN STATES.

AUGUSTA, ME.—The Hiram Water, Light & Power Company and the Western Maine Power Company have filed a joint petition with the Maine Public Utilities Commission asking authority for the former to convey to the latter all its rights and property. The Western Maine asks authority to issue $52,500 of six-per cent preferred stock and $120,000 of 20-year five-per cent first-mortgage bonds. A bill is before the Maine legislature which would give the company authority to extend its lines and furnish service through several towns of eastern Maine.

BANGOR, ME.—The Bangor Railway & Electric Company has contracted with the Eastern Manufacturing Company, Lincoln, Me., to supply 2,000 electric horsepower. About $75,000 will be expended in building a transmission line from the Ellsworth, Veazie and Milford stations.

BIDDEFORD, ME.—The Pepperell Manufacturing Company of this city has under contemplation the leasing of its power privileges along the Saco River to the Cumberland County Light & Power Company, for development. The Pepperell company already has leased its water privileges at Hiram Falls to the Cumberland County company and a power plant is being erected there. It is expected it will develop 10,000 horsepower.

CARIBOU, ME.—This town may acquire the rights and property of the Caribou Water, Light & Power Company, if a bill which is before the Maine Legislature is enacted.

MILO, ME.—The local central station is seeking public authority to extend its transmission lines into neighboring territory.

VAN BUREN, ME.—Representative Hammond of Van Buren introduced an act to incorporate the Van Buren Light and Power Company district with the rights of making, generating, purchasing, and selling etc., electricity and gas. The district is authorized to purchase the capital stock, plants, property, etc., of the Van Buren Light and Power Company and provision is made for price to be arranged by the supreme court in case of disagreement.

PORTSMOUTH, N. H.—The Rockingham County Light & Power Company was recently damaged by fire to the extent of $20,000.

MONTPELIER, VT.—The Montpelier & Barre Light & Power Company will extend its service to the town of East Calais. The company will then serve every community in the county except three. The area has 38,000 population, and there are about 4,700 meters.

ATTLEBORO, MASS.—The Attleboro Steam & Electric Company has enlarged the street lighting schedule to 260 hours a year, at the same price as in years past. The cost was $19,000 in 1916.

FALL RIVER, MASS.—It is understood that the Waterways Commission of the state will grant the request of the Fall River Electric Light Company for permission to string high-tension wires across the Taunton River.

MARLBORO, MASS.—The city's committee on street lights is conferring with the Marlboro Electric Company in regard to installing new and better lights in the main streets of the city.

PAWTUCKET, R. I.—A bill is before the Legislature which would amend the charter of the Blackstone Valley Gas & Electric Company by allowing the increase of capital stock from $4,000,000 to $8,000,000.

PROVIDENCE, R. I.—A bill has been introduced in the Rhode Island Legislature which would give the Rhode Island Power Transmission Company the right to extend its lines to any portion of the state.

PROVIDENCE, R. I.—A bill has been referred to the State Committee on Corporations to allow the Narragansett Electric Lighting Company to increase its stock to $12,000,000. It is now capitalized at $6,000,000.

BRIDGEPORT, CONN.—The Lamp committee of the city's Common Council intend to bring up the question of extending the white-way lights on State and East Main Streets and Stratford Avenue.

HARTFORD, CONN.—Bills have been introduced in the state assembly which would authorize the Meriden Electric Light Company to increase its capital stock to $1,000,000, and permit the Farmington River Power Company to sell electricity in New Britain and convey it to the plant of the Stanley works, recently purchased.

GLEN FALLS, N. Y.—The Adirondack Electric Power Corporation is taking over neighboring power companies, including The Schenectady Illuminating Company, The Mohawk Gas Company, The Schenectady Power Company, The East Creek Electric Light & Power Company and The Edison Electric Light & Power Company. These companies include developed water power of 29,600 horsepower, but are essentially retailers, while the Adirondack Corporation, with water power of 21,000 horsepower, is at present chiefly a wholesaler. The plan of the new combination is to extend the distributing system.

NEW YORK, N. Y.—The "Brighten Up Sixth Avenue" Association has been organized by property owners along the thoroughfare to establish a new "white way" street-lighting system. Mark A. Luescher of the New York Hippodrome is prominent in the association.

NORTH TONAWANDA, N. Y.—Plans have been inaugurated in this city to build a municipal plant to supply this and neighboring towns. The cost of street lighting in the cities included is now $28,000 annually.

JERSEY CITY, N. J.—The Lehigh Valley Railroad is making investigations for the electrification of its main line from Jersey City to Wilkes-Barre, Pa., 176 miles, and from Penn Haven Junction to Mt. Carmel, 52 miles. It is proposed to use the present power plants of the Lehigh Coal & Navigation Company at Hauto and Harwood, of 30,000 and 20,000 kilowatts capacity, respectively, and establish other power plants at convenient points for operation. The project is estimated to cost $11,500,000.

PATERSON, N. J.—A movement has been started to establish a "white way" in this city. The city Chamber of Commerce is pushing it.

PRINCETON, N. J.—The Council has made an appropriation in its annual budget for the installation of additional street lights.

SEWELL, N. J.—The Township Committee is considering the installation of an electric-lighting system.

CATASAUQUA, PA.—Borough officials have made application to the Public Service Commission for permission to build a municipal electric plant.

PHILADELPHIA, PA.—The low bid for the erection of a new power station at the Erie-Avenue Yards of the Philadelphia & Reading Railroad was submitted by Fred A. Havens, 845 North Nineteenth Street, at $38,403.

PILOT MOUNTAIN, N. C.—C. M. Bernard is interested in the installation of an electric light and water plant.

ATLANTA, GA.—In order to carry more evenly the increased city arc load, which has grown steadily, four new substations are to be installed by the Georgia Railway & Electric Company and the changes thus made will call for revision of every one of the 38 city arc circuits, which means new wires to be strung, new poles set up, etc. F. B. Davenport is engaged on the detail plans for this work.

ORLANDO, FLA.—The city contemplates voting on $20,000 bonds for a white-way and lighting system. Address Jas. L. Giles, mayor.

NORTH CENTRAL STATES.

CINCINNATI, O.—Plans for the construction of a boulevard lighting system for the downtown streets are ready to go before the city council. They involve 14 streets, with arrangements for assessments amounting to $43,362.15.

CINCINNATI, O.—It is under contemplation to sell the Madisonville electric light plant which is owned by the city. This plant is operated to furnish light at 8½ cents. The price would result in a loss to the city, according to experts. The plan is to sell the property at auction to the highest bidder.

DELPHOS, O.—Improvements to cost $100,000 will be made on Delphos Electric Light & Power Company by Hooper, Kimball & Williams, of Boston. The plans provide for new wiring between Delphos and Van Wert, requiring 40 miles of new wire. A concrete substation will be built near the present plant to house high-tension transformers, switches, lightning arresters and other equipment. W. G. Hurd is manager.

EAST LIVERPOOL, O.—The Ohio River Power Company's lease on the light and power holdings of the Steubenville and East Liverpool Railway & Light Company has become effective. The new company, which is just completing a power plant at Beech Bottom, W. Va., along the Ohio River, will locate offices in both East Liverpool and Steubenville. A. C. Martin has been appointed manager.

SHERIDAN, IND.—The Sheridan Water, Light & Heat Company has petitioned for authority to issue $10,000 in bonds for an extension to its electric light plant. Clyde E. Layton is secretary.

SPRING VALLEY, ILL.—A proposition to electrify the water plant and purchase the current to operate the machinery from the Spring Valley Utilities Company was submitted to the Spring Valley Council. The Utilities company offers to install the necessary machinery at the pumping plant and put the same in operation at its own expense.

GRAND RAPIDS, MICH.—The Consumers' Power Company is to build an addition to its steam plant on Wealthy Street, S. W., to cost $68,000. Work will be started soon.

ISHPEMING, MICH.—The Marquette County Gas & Electric Company has taken over the Appleyard interests which were operating various plants in the northern peninsula of Michigan.

LOWELL, MICH.—A meeting of city officials will be held February 19 to decide on the question of issuing $40,000 in bonds to rebuild the city's electric light and power plant. Address the town clerk.

EAU CLAIRE, WIS.—The Wisconsin-Minnesota Light & Power Company is developing all available water-power locations in this section and has just completed a plant here.

MILWAUKEE, WIS.—Public Works Commissioner Simmons is investigating the question of erecting a new power plant. The site suggested will cost about $30,000 and the plant $40,000 more.

SCHLEISINGERVILLE, Wis.—This city has been released from its contract with the city of Hartford and will receive electricity from the Milwaukee Electric Railway & Light Company in the future.

WATERLOO, WIS.—An ordinance has been passed for the borrowing of $4,000, with which to make additions to the municipal electric plant. Some people of the town, however, prefer to bring extra power in from Kilbourn.

WHITEWATER, WIS.—The city intends to replace its old electrical distributing system. The wire is too small to carry the load and the estimated cost of the rewiring is $25,000. Address J. C. Partridge, secretary.

DEER RIVER, MINN.—The Everton Electric Light & Power Company has been purchased by H. M. Dungan and H. E. Griswold, stockholders in the Home Electric & Heating Company. The new owners will take charge of the plant March 1. Plans for remodeling it are being prepared.

ANTHON, IA.—Bids have been closed by L. L. Lucas for the building of a light and power plant and work will be started soon.

CUMBERLAND, IA.—Bonds have been voted for municipal electric lights.

DE KALB, MO.—The St. Joseph Railway, Light, Heating & Power Company is to furnish electricity to the recently formed De Kalb Light & Power Company of this city. H. L. Graves is president of the latter named company.

FESTUS, MO.—The Missouri Electric Company has purchased the municipal electric light plant and is contemplating improvements to include the extension of transmission lines.

JEFFERSON CITY, MO.—The Union Electric Light & Power Company of St. Louis has obtained authority from the Public Service Commission to absorb the Missouri Electric Light & Power Company. The commission authorized the issuance of $3,000,000 of extra capital and $1,600,000 in bonds, to be used in taking over the property of the Missouri company. The capital stock of the Union Electric was increased from $18,040,000 to $21,040,000.

JOPLIN, MO.—The proposition to issue $195,000 municipal-light bonds will be submitted to vote March 1. J. F. Lee is commissioner of public utilities.

KIRKSVILLE, MO.—The North American Securities Company, owning the electric light plant, will make improvements. Small towns between Kirksville and Booneville which do not have electricity now will be served. S. Landecback is general manager.

NEWTON, MO.—Plans are being discussed which state that the city of Princeton agrees to furnish Newton with electricity. Newton will build its own line, according to plans and specifications agreed upon by the city of Princeton.

SWEET SPRINGS, MO.—The council has decided to install an additional oil engine and alternating-current generator in the city's electric light plant. Address the mayor.

WARRENSBURG, MO.—This city contemplates the installation of an electric light plant. Address the mayor of the city.

McPHERSON, KANS.—The question of enlarging the lighting plant of this city has been under investigation. Commissioner J. W. Jenkins has been very active in this respect and has found that the business men of the city are strongly in favor of the enlargement.

MORAN, KANS.—The Connor Construction Company of Kansas City has been awarded the contract for the construction of the Moran water and light plant and work has been started.

WASHINGTON, KANS.—Fire destroyed the engine room of the electric light plant in this city.

CHADRON, NEB.—The city council has passed on an act which provides for the improving of the city's lighting system.

BOWMAN, N. D.—The Western Electric Light & Power Company, owning light plants at Bowman and Marmarth, N. D., are contemplating a bond issue to make improvements in their holdings and perhaps extend them.

SOUTH CENTRAL STATES.

GUTHRIE, KY.—The South Kentucky Power Company has purchased the lighting plant at Elkton.

MONTICELLO, KY. — The Monticello Light & Power Company has purchased an old mill and water rights of Martin Black. It is the plan of the company to convert the old mill into a hydroelectric plant. All lighting installations will be metered.

PADUCAH, KY.—Frank L. Wilcox and H. T. Ward, electrical engineers of St. Louis, Mo., are making a preliminary survey of the local lighting plant and the city's requirements, in connection with the project to establish a municipal lighting plant there. Statements made by the engineers were to the effect that a new plant on the unit system would probably be best. Mayor Burns and the commission are expected to take some definite action soon and are expected to take bids for a survey to fix the approximate cost of a plant.

LAWRENCEBURG, TENN. — There is strong talk of a new "white way" in this city and it is apparently approved by the people.

RIPLEY, TENN.—Lauderville Light & Power Company. Capital, $20,000. W. W. Craig is manager.

BIRMINGHAM, ALA. — The Alabama Public Service Commission may relieve the city commission from waging the fight to make the Birmingham Railway, Light & Power Company install the 150 street lights that have been ordered in service.

BIRMINGHAM, ALA.—It has been voted and ruled by court that this city may issue $500,000 in bonds and use the proceeds for enlarging the present municipal plant or building a new plant.

LOCKESBURG, ARK.—A movement has been started here to put in an electric-light plant. The city council will grant a franchise to one of several concerns.

MONROE, LA.—Improvements are necessary at the light plant. Address W. G. Kirkpatrick, city engineer.

BARTLESVILLE, OKLA. — The Midco Gasoline Company is to invest $2,000,000 here in the building of a power plant and many other improvements. The power plant is in course of construction just south of the city.

HASKELL, OKLA.—The city voted $20,000 in bonds with which to install an electric lighting plant. Address the mayor.

NORMAN, OKLA.—The Norman electric light and ice plant has just been sold to the Oklahoma Gas & Electric Company, said to be backed by H. M. Byllesby & Co., of Chicago, who own the electric light plant at Oklahoma City. Norman may be supplied with current from a central station to be established at Oklahoma City, in the future.

STRONG CITY, OKLA.—Strong City will put in electric lights and Francis Walker has taken the contract for putting in a municipal plant.

ALICE, TEX.—Morrison & McCall, of St. Louis, Mo., have purchased the lighting plant here and will improve and furnish electricity to San Diego, Tex.

DALLAS, TEX.—The Texas Electric Railways plans to extend its line from Waco to San Antonio, via Austin, a distance of about 185 miles. The power for operating this additional mileage will be obtained from a new plant which the Texas Power & Light Company will build at Austin.

DALLAS, TEX. — The Commissioner's Court of Dallas County has awarded the contract for installing a new unit at the county power house at a cost of $15,000.

PORT ARTHUR, TEX.—Manager Bowse of the Port Arthur Light & Power Company gave out information that the added improvements to the property in this city would cost in the neighborhood of $400,000. The equipment will triple the present capacity of the plant. The work is in preliminary stages at present.

WESTERN STATES.

GLENDIVE, MONT.—The General Utilities Company, Fargo, N. D., and St. Paul, Minn., owning 17 electric light and power plants in the central west, may extend operations into western North Dakota and eastern Montana.

COLUMBUS, N. M. — The Columbus Electric Light & Power Company, which has been organized with a capital of $200,000, will build an electric power plant here. J. L. Greenwood is the principal stockholder.

SNOWFLAKE, ARIZ.—The city is considering the building of a municipal electric light plant.

YUMA, ARIZ.—F. E. Trask has presented the city council with a proposition by which he will undertake to procure a municipally owned water, gas, light and power plant for Yuma.

SALT LAKE CITY, UTAH.—A. S. Ross, general manager of the Pittsburgh-Idaho Mining Company, will leave soon for the east. He intends to purchase electrical equipment with which to electrify the mines throughout. The company will install its own generator.

SALT LAKE, UTAH.—Money for electrifying the Saltair railroad has been definitely arranged for, according to Joseph Nelson, general manager.

AUSTIN, NEV.—A bill has been introduced in the State Legislature providing for the issuance of a franchise to C. E. Rice and W. H. Berg for the construction of a power plant in this city.

LOVELOCK, NEV.—Negotiations have been started by the Louisiana Consolidated Mining Company with the Nevada-California Company for the construction of a power line to the old camp of Tybo. The line will be built from Belmont, a distance of 29 miles, and will cost in the neighborhood of $30,000.

GRANGEVILLE, IDAHO.—The Grangeville Electric Light & Power Company will build a solid concrete dam across the Clearwater River, 375 feet long and 55 feet high, and capable of generating 10,000 horsepower. It is estimated that the dam will cost between $40,000 and $60,000.

SPOKANE, WASH. — The Senate of Washington has passed a bill authorizing the raising of the water along the fort target range for the development of a large power project by the Spokane Valley Power Company.

TACOMA, WASH.—G. L. Parker, district engineer U. S. Geological Survey, announces that the Washington Irrigation & Development Company will develop a 500,000-horsepower electric plant nine miles from Beverly. The cost will be about $25,000,000 to $30,000,000. The company, which is a New York concern, through its consulting engineer, M. O. Leighton, Washington, D. C., is co-operating with the state and government geological surveys in the matter. This move doubtless has direct bearing on the fact that the Chicago, Milwaukee and St. Paul Railway Company is to electrify 210 miles of its line in Washington from Seattle to Othello.

BEND, ORE.—The Bend Water, Light & Power Company will make extensive repairs, including a new power unit and additions to the electric and water distribution systems. Kempster B. Miller is chief engineer.

PORTLAND, ORE.—Commissioner Daily recommends installing a municipal light plant, estimated to cost $1,750,000.

WALLOWA, ORE.—The construction work on the transmission line between Enterprise and Joseph has been completed by the Enterprise Electric Company. The Joseph plant was bought a few months ago by the Enterprise Electric Company from the Joseph Light & Power Company. The former is now operating in the towns of Joseph, Enterprise, Lostine, Evans and Wallowa. The headquarters of the company are at Spokane, Wash., with W. C. Sivyer as president, B. L. Sivyer, secretary and treasurer, and L. M. Simpson, general manager.

WALLOWA, ORE.—The Grangeville Light & Power Company, operating in the towns of Cottonwood, Vollmer, Ilo, Nez Perce, Orofino, Kamiah and Grangeville, Idaho, will begin work at once on a large dam 30 feet high, to take the place of a flume which has been destroyed three times of late by slides.

BURBANK, CAL.—The California-Arizona Construction Company was awarded the contract for the installation of the new ornamental street-lighting system. Their bid was for $6,571.

CHICO, CAL.—Dennis Murphy, owner of a power plant site on Deer Creek, will appear before the Business Men's Association to renew his proposal to build a municipal lighting system. Murphy wants to sell his water rights to the city. It is estimated that the cost of the plant would be about $500,000, and $250,000 for the transmission lines and distributing system.

FRESNO, CAL.—The contract for the construction of an electrolier system of street lighting on J Street was awarded to the Valley Electrical Company on their bid of $6,950.

LOS ANGELES, CAL.—Twenty thousand signatures have been secured by the parties back of the initiative petition providing for the sale of aqueduct power at wholesale rates to companies distributing electrical power.

DATES AHEAD.

Wisconsin Electrical Association. Annual meeting, Hotel Pfister, Milwaukee, Wis., March 15-16. President, W. E. Haseltine, Ripon, Wis.

National Association of Electrical Inspectors. Biennial convention, New York, March 27-29. Chairman committee on arrangments, Alfred E. Braddell, Sprague Electric Co., New York City.

Tri-State Water and Light Association of the Carolinas and Georgia. Annual convention, Macon, Ga., April 17-19. Secretary, W. F. Steiglitz, Columbia, S. C.

Southwestern Electrical and Gas Association. Annual convention, Dallas, Tex., April 26-28. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Tex.

National Fire Protection Association. Annual meeting, Washington, D. C., May 8-10. Secretary-treasurer, Franklin H. Wentworth, 87 Milk Street, Boston, Mass.

Arkansas Association of Public Utility Operators. Annual convention, Pine Bluff, May 16-18. Secretary-treasurer, R. B. Fowles, Pine Bluff Company, Pine Bluff, Ark.

Electrical Supply Jobbers' Associations. Semi-annual meeting, Homestead Hotel, Hot Springs, Va., May 22-24. Secretary, Franklin Overbagh, 411 South Clinton Street, Chicago, Ill.

LOS ANGELES, CAL.—Damage, which will cost the company $75,000, and will take several months to repair, was suffered by the power lines of the Southern Sierras Power Company in Inyo county during the recent storms.

LOS ANGELES, CAL.—Included in a large appropriation for fortifications contained in a bill presented to Congress are funds for generating sets for electric light and power plants for fortifications at Los Angeles and San Diego.

LOS ANGELES, CAL.—The Board of Supervisors has been asked to establish a highway lighting district, to be known as the Jefferson Lighting District of Los Angeles County.

LOS ANGELES, CAL.—The City Council has approved the location of a proposed electric power line in and through Elysian and Griffith Parks.

MARTINEZ, CAL.—The Pacific Gas & Electric Company is installing an entire new street lighting system in this city.

MARTINEZ, CAL.—A plant costing more than $500,000 will be erected here soon by an Eastern concern.

MODESTO, CAL.—A fourth power line will be constructed by the Sierra & San Francisco Power Company to connect with the 204,000-volt transmission line reaching San Francisco from the power plant on the Stanislaus River. The new line will connect with the transmission line at Manteca, and will cost $36,000. The company will build a substation at Oakdale at a cost of $10,000.

NOVATO, CAL.—This city has called for bids for installing and maintaining the lighting system in the Novato lighting district.

OROVILLE, CAL.—The Oro Electric Corporation has been taken over by the Pacific Gas & Electric Company. It intends to remodel the lighting system and spend about $35,000 in repairing the waterpower system.

REDDING, CAL.—The Northern California Company will build a 60,000-volt line from Keswick to French Gulch, a distance of 15 miles.

SALINAS, CAL.—This city will install an ornamental lighting system soon. Plans are being prepared by C. T. Phillips, of San Francisco, which call for 65 electroliers.

SAN PEDRO, CAL.—The new fortification bill passed by Congress provides for electric light and power plants for the fortifications at San Pedro and San Diego.

SANTA, ANA, CAL.—The San Diego Consolidated Gas & Electric Company has been granted a franchise for the construction of an electric-light and power system in this city.

SANTA MONICA, CAL.—A petition has been presented to the City Council asking for the installation of an ornamental lighting system on Second Street between Utah Avenue and Santa Monica Boulevard.

SANTA ROSA, CAL.—The Santa Rosa City Council has called for bids on the installation of the new electrolier lighting system and furnishing the electricity for lighting. The new system will be of the staggered type of spacing.

SONORA, CAL.—This city is considering the establishment of a municipal electric light and power plant. Arrangements have been made for an engineer to prepare an estimate of the cost.

VENICE, CAL.—The City Council has been presented with a petition for the construction of a concrete sea wall and walk with lighting posts along the frontage of lots A to G in the Ocean Strand Tract.

WEAVERVILLE, CAL.—The State Railroad Commission has authorized the Western States Gas & Electric Company to extend its transmission and distributing lines in Trinity county.

WINTON, CAL.—The San Joaquin Light & Power Company, Walter Casad, manager, is extending its transmission line into this city, and wires are to be placed for a lighting system.

Foreign Trade Opportunities

[Addresses may be obtained from the Bureau of Foreign and Domestic Commerce, Washington, D. C., or its offices at Boston, New York, Atlanta, Chicago, St. Louis, New Orleans, Seattle and San Francisco. Write on separate sheet for each item and give file number.]

No. 23,416. ELECTRICAL APPLIANCES. A firm in Switzerland wishes to purchase electrical appliances and tools. Quotations should be made c. i. f. European port. Cash will be paid against documents. Correspondence should be in French or German. References.

No. 23,459. ELECTRIC HEATING APPLIANCES. A firm in Norway desires to secure an agency for the sale of electric heating appliances, such as ranges, toasters, etc. Catalogues should be sent. Correspondence may be in English. Reference.

NO. 23,577. TINNED STEEL WIRE.—The government of a neutral European country is in the market for 15 tons of tinned steel wire, 0.012 of an inch in diameter, with a resistance of 485.0166 pounds per square millimeter 0.00155 of an inch.

NO. 23,589. ELCTROTHERAPEUTIC APPARATUS.—A woman in Canada desires to secure an agency for the sale of physicians' electrotherapeutic apparatus for such work as high-frequency treatment, massage, ultra violet ray treatment, etc. Correspondence may be in English. References.

NO. 23,596. ELECTRICAL SUPPLIES.—A firm in India desires to get in touch with American manufacturers and exporters of electric lamps, fans and fittings, etc. Quotations should be made c. i. f. Indian ports. Correspondence may be in English. References.

NO. 23,700. SMALL LIGHTING APPLIANCES.—A man in Spain is desirous of securing an agency for the sale, in wholesale quantities, of small electric apparatus for lighting and other purposes. Correspondence may be in English. References.

Financial Notes

Southern California Edison Company, Los Angeles, Cal., reports gross earnings for December $412,182, decrease $730; net after all charges $94,313, increase $10,672. Gross for 12 months $4,901,374, increase $92,767; net $1,146,001, increase $134,684.

Pacific Light & Power Company, Los Angeles, Cal., reports gross earnings for December $283,430, increase 10.02 per cent; net $179,325, increase 8.05 per cent. Gross for 12 months $3,261,126, increase 11.47 per cent; net $2,137,513, increase 10.02 per cent.

The Cleveland Electric Illuminating Company in 1916 showed $1,601,592.12 in profits, according to its annual financial statement. In March, 1914, the City Council ordered the illuminating company to reduce its rates to domestic consumers to a maximum of 3 cents a kilowatt hour. The company is still charging a 10-cent rate because the public utilities commission has not heard its appeal from the Council's order. The company distributed profits as follows: To preferred stockholders a six-per-cent dividend totaling $48,000; to common stockholders, an eight-per-cent dividend totaling $781,080; for interest on bonds, $401,982.97. In addition, the company added $370,629.15 to surplus account. The company in 1916 spent $510,973 in renewing and replacing old machinery.

Commonwealth Power, Railway & Light Company reports gross earnings for year ended December 31, 1916, of $16,962,606, increase $2,372,463; net $2,651,742, increase $356,155. The income account of the holding company for the year showed gross earnings of $3,458,729, increase $376,872, and surplus of $1,632,572, increase $298,985.

Intermountain Railway Light & Power Company reports gross earnings for year ended December 31, $248,817, compared with $164,662 in 1915; net $103,532, against $62,-273; surplus $71,151, against $37,964.

The annual report for the Kings County Electric Light & Power Company, Brooklyn, N. Y., shows earnings during the year ended December 31, 1916, as follows:

Gross Revenue	$8,130,199.22
Operating Revenue Deductions:	
Operating Expenses	3,582,683.38
Taxes	663,236.62
Reserve for Replacements	768,130.03*
Total	5,014,050.03
Net Operating Revenue	3,116,149.19
Net Non-operating Revenue	74,609.44
Gross Income	3,190,758.63
Reserved for Contingencies	569,174.65
	2,621,583.98
Income Deductions:	
Interest on Funded Debt	683,540.00*
Interest on Unfunded Debt	57,819.81
Bond Discount Written Off	20,268.81
Total	761,628.62*
Net Income	1,859,955.36
Dividends	1,202,564.00
Payment to Edison Investment Fund in Accordance with Employees' Profit Sharing Plan	89,630.44
Appropriations and Adjustments Previous Years	1,385.25
Total	1,293,579.69
Balance to Credit of Profit and Loss	566,375.67
Previous Profit and Loss Balance	2,597,440.28
Total Profit and Loss Balance	$3,163,815.95

Items marked "*" show a lower figure than during 1915.

WEEKLY COMPARISON OF CLOSING-BID PRICES OF SECURITIES OF LEADING ELECTRICAL COMPANIES.

Quotations furnished by F. M. Zeller & Co., Rookery Bldg., Chicago.

	Div. Rate Per Cent	Bid Feb. 5	Bid Feb. 12
Public Utilities—			
Adirondack Electric Power of Glens Falls, common	....	26½	23
Adirondack Electric Power of Glens Falls, preferred	6	88	83
American Gas & Electric of New York, common	10+extra	140	140
American Gas & Electric of New York, preferred	6	51	51
American Light & Traction of New York, common	....	364	362
American Light & Traction of New York, preferred	6	111	112
American Power & Light of New York, common	4	85	85
American Power & Light of New York, preferred	6	92½	90
American Public Utilities of Grand Rapids, common	....	39	39
American Public Utilities of Grand Rapids, preferred	6	70	70
American Telephone & Telegraph of New York	....	124	124⅜
American Water Works & Elec. of New York, common	....	14	10½
American Water Works & Elec. of New York, particip	7	25	25
American Water Works & Elec. of New York, first preferred	....	70	69
Appalachian Power of Bluefield, common	....	7¼	7
Appalachian Power of Bluefield, preferred	7	39	39
Cities Service of New York, common	6+extra	280	277
Cities Service of New York, preferred	6	89¾	87¼
Commonwealth Edison of Chicago	8	134	135
Comm. Power, Railway & Light of Jackson, common	4	60	57
Comm. Power, Railway & Light of Jackson, preferred	6	81½	80
Federal Light & Traction of New York, common	....	14	14
Federal Light & Traction of New York, preferred	....	54	53
Illinois Northern Utilities of Dixon	6	82	82
Middle West Utilities of Chicago, common	2+2 extra	61	60
Middle West Utilities of Chicago, preferred	6	79	79½
Northern States Power of Chicago, common	7	103	102
Northern States Power of Chicago, preferred	7	98	97½
Pacific Gas & Electric of San Francisco, common	5	64½	63½
Pacific Gas & Electric of San Francisco, preferred	6	92	92
Public Service of Northern Illinois, Chicago, common	7	109	107½
Public Service of Northern Illinois, Chicago, preferred	6	100	99
Republic Railway & Light of Youngstown, common	4	47	42
Republic Railway & Light of Youngstown, preferred	6	73	73
Standard Gas & Electric of Chicago, common	....	13½	10½
Standard Gas & Electric of Chicago, preferred	6	39	37½
Tennessee Railway, Light & Power of Chattanooga, common	....	9	8½
Tennessee Railway, Light & Power of Chattanooga, preferred	6	42	41
United Light & Railways of Grand Rapids, common	4	46	46½
United Light & Railways of Grand Rapids, preferred	6	76	76
Western Power of San Francisco, common	....	17	16½
Western Power of San Francisco, preferred	6	67	66½
Western Union Telegraph of New York	5+ extra	†94	†94
Industrials—			
Electric Storage Battery of Philadelphia, common	4	†63	62
General Electric of Schenectady	8	†163	†161½
National Carbon of Cleveland, common	8	†300	†300
National Carbon of Cleveland, preferred	7	†130¼	†130¼
Westinghouse Electric & Mfg. of Pittsburgh, common	5+ extra	†49	†51½
Westinghouse Electric & Mfg. of Pittsburgh, preferred	7	69	69

†Last Sale.

Proposals

COPPER WIRE.—The commissioner of light and water, Tacoma, Wash., has called for bids for delivering and furnishing f.o.b. Tacoma 25,000 pounds of weatherproof double-braid copper wire in several different sizes.

ELECTRIC LIGHTING SYSTEM.—Service Director Hornberger wants bids for the installing of a permanent electric lighting system on the new Hopple Street viaduct, plans and specifications for which have been completed. The cost is estimated at $12,000 to $14,000, and the installation will consist of 60 nitrogen incandescent lamps of 100 candlepower each, mounted on poles on both sides of the viaduct, Hopple Street, Cincinnati, O.

INCANDESCENT LAMPS.—The Commissioner of Light and Water has called for bids for $20,000 worth of incandescent lamps, to be delivered f. o. b. in Tacoma, Wash., within one year.

ELECTRICAL EQUIPMENT.—Sealed bids will be received February 26, at room 406, City Hall, for furnishing and installing the entire electrical equipment required for a bascule bridge over the Chicago River at Franklin-Orleans Streets, according to plans and specifications on file in the office of the Department of Public Works, City Hall, Chicago, Ill.

NAVY ELECTRICAL SUPPLIES.—Bids will be received by the Bureau of Accounts and Supplies, Navy Department, Washington, D. C., for supplies for the following Naval Stations: Boston, Mass., Schedule No. 717, one set of engine order telegraph system; Philadelphia, Pa., Schedule No. 704, six searchlight projectors, 13,500 feet of double-conductor flexible cable, 1,500 carbons for 30-inch lamps and 11 gasoline generator sets; Mare Island, Cal., Schedule No. 721, 900 pounds of copper wire; Brooklyn, N. Y., Schedule No. 711, 21,500 feet of interior-communication cable and 251,200 feet of single and twin-conductor cable; Schedule No. 702, two ringing dynamotors, one telephone motor generator, a telephone switchboard and 141 fire-control telephones; Schedule No. 697, insulating material.

GENERATORS, ETC.—The Board of Public Works, Seattle, Wash., will receive bids March 16 for furnishing and installing equipment for addition to auxiliary steam power plant on Lake Union. It will cost about $300,000. Building contract to be awarded amounts to about $100,000. Bids are to be taken on the following units. Boiler feed pumps and service pumps, steam turbo generator, reactance coils, exciter, etc., high vacuum set condenser, air and water pumps, etc. A surety bond or certified check for five per cent of the bid, payable to the order of the city comptroller is required.

ALTERNATOR, MOTORS AND WIRING.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 19, 1917, for furnishing and installing an alternator in connection with an engine furnished by the government; boilers, condensers, pumps, motors, switchboard, equipment, piping, wiring, lighting, etc., for the heating and power plant at the Naval Torpedo Station, Puget Sound, Wash. Drawings and specifications may be obtained on application to the Bureau of Yards and Docks, or to the commandant of the navy yard named.

Electrical Patents Issued February 6, 1917

Prepared by Thomas Howe, Patent Attorney, 2 Rector Street, New York, N. Y.

1,214,500. Anode for Vacuum Discharge Tubes. C. F. W. Bates, assignor of one-half to C. L. Gebauer, Cleveland, O. Tungsten target is within iron shield about which a copper base is cast.

1,214,511. Telephone Switching System. H. P. Clausen, assignor to Western Electric Co., New York, N. Y. Has supervisory system for indicating failure to answer at predetermined intervals.

1,214,512. Telephone Switching System. H. P. Clausen, assignor to Western Electric Co. Time controlled mechanism extends line with unanswered call to second operator's position.

1,214,514. Lamp Fixture. A. D. Curtis, assignor to National X-Ray Reflector Co., Chicago, Ill. Indirect, with special provision for heat dissipation.

1,214,515. Switch Selector. O. A. Danielson assignor to Western Electric Co. Number of switches are selectively operated from a common actuator.

1,214,524. Vehicle Lamp. E. J. Edwards, assignor to General Electric Co., Schenectady, N. Y. Headlight reflector structure.

1,214,528. Electric Ship Propulsion. W. L. R. Emmet, assignor to General Electric Co. Controlling arrangements for system having propelling motor operated from turbine driven generator.

1,214,540. Electrically Operated Tabulating and Like Machine. C. A. E. A. Greene, London, England. Contact structure.

1,214,555. Starting and Ignition Apparatus. B. M. Leece, assignor to Leece Neville Co., Cleveland, O. Special arrangement of dynamo electric machine, battery and ignition coil.

1,214,582 and 1,214,583. Automobile Lamp. W. F. Persons, assignor to Guide Motor Lamp Mfg. Co., Cleveland, O. First patent: Structure of headlight casing. Second patent: Headlight reflector structure.

1,214,610. Telephone Receiver. N. Tannaka, New York, N. Y. Special diaphragm mounting.

1,214,613. Vapor Electric Apparatus. P. S. Thomas, assignor to Cooper Hewitt Electric Co., Hoboken, N. J. Entrance to condensing chamber is restricted so that sufficient operating vapor can pass only under normal operating pressure.

1,214,615. Electrically Controlled Brake. W. V. Turner, assignor to Westinghouse Air Brake Co., Wilmerding, Pa. Has electrically controlled pneumatic valves.

1,214,616. Electropneumatic Brake. W. V. Turner, assignor to Westinghouse Air Brake Co. Electrically controlled vent valve for brake pipe responsive when rate of brake pipe reduction exceeds a predetermined limit.

1,214,620. Means for Producing Electrical Oscillations with the Aid of an Auxiliary Oscillation Circuit. G. Von Arco and A. Meissner, assignors to Gesellschaft fur Drhatlose Telegraphic M. B. H., Berlin, Germany. For producing damped oscillations of high or medium frequency.

1,214,621. Vehicle Display Device. T. H. Wadden, Keokuk, Iowa. Structure of casing, etc., for illuminating display plate.

1,214,624. Alarm for Railroad Crossings. B. D. Whitcomb, Shawomet, R. I. Comprises time controlled relay circuits.

1,214,638. Selective Lockout Telephone System. F. W. Adsit, St. Paul, assignor to Adsit General Electric Co., Minneapolis, Minn. Metallic party line has grounded bell, magneto and step-up sector at each station.

1,214,644. Electric Light Socket. T. A. C. Both, assignor to Zee Socket & Mfg. Co., Boston, Mass. Relates to switch structure; has rotary resilient operating member.

1,214,647. Battery Cell. C. C. Carpenter and R. J. Ellis, assignors to U. S. Light & Heat Corp., Niagara Falls, N. Y. Structure of jar cover.

1,214,652. Lightning Rod Structure. J. E. Curti, Omaha, Neb. Comprises a horizontal cable with tubes extending therefrom.

1,214,655. Wireless Telephone Apparatus. B. V. Deitz, Slingerlands, N. Y. A detector comprises fused silicon, zinkite and copper ore forming a simple voltaic cell.

1,214,663. Motor Controller. C. T. Evans, assignor to Cutler Hammer Mfg. Co., Milwaukee, Wis. Winding arrangements of electromagnetic, resistance-controlling switches.

1,214,667. Supporting Means for Electric Light Fixtures. S. A. Framburg, assignor to H. A. Framburg & Co., Chicago, Ill. Hanger for illumination bowls.

1,214,669. Battery Cell. J. M. Gauss, assignor to U. S. Light & Heat Corp., Niagra Falls, N. Y. Structure of jar cover.

1,214,680. Motor Drill. G. F. Hochriem and L. E. Hochriem, Chicago, Ill. Disengagement of driving clutch opens circuit of motor and clutch permits slip upon abnormal strain on drill.

1,214,686. Supervisory System. A. E. Keith, assignor to Automatic Electric Co., Chicago, Ill. In automatic trunking system.

1,214,694. Telephone System. A. D. T. Libby, assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. Comprising service meter.

1,214,698. Electric Fan. W. M. McEwen, Chicago, Ill. Vertically tilts and produces gyratory forces, causing horizontal oscillation.

1,214,718. Overload Circuit Opener. E. O. Schweitzer, Chicago, Ill. In a polyphase system, a fuse in one line is operated by heating coils in other lines.

1,214,721 and 1,214,722. Signal. W. Sparks, assignor to Sparks, Withington Co., Cleveland, O. Horns with motor operated diaphragms.

1,214,744. Mechanical Battle. J. Bailey, assignor of one-half to H. A. Jeager, Jersey City, N. J. Electrically operated toy.

1,214,745. Hoist Block. C. E. Beard, Columbiana, and W. G. Stephen, Cleveland, O. Comprises weighing device with electrically operated indicator.

1,214,752. Electric Switch. H. R. Canfield, assignor to Electric Controller & Mfg. Co., Cleveland, O. Electromagneticaly operated; is not operated when current is excessive.

1,214,757. Electric Water Seater and Automatic Control. D. B. Clark, Bemus Point, N. Y. Resistors controlled by water flow through outlet.

1,214,763 and 1,214,764. Electrically Heated Steel Furnace. J. L. Dixon, Detroit, Mich. Polyphase arc furnace.

1,214,771. Time Switch. U. D. Fortier, Tulsa, Okla. Solenoid operated.

1,214,775. Electrolytic Apparatus. W. E. Greenawalt, Denver, Colo. Structure of electrode bell.

1,214,779. Electric Switch. J. H. Hall, assignor to Electric Controller & Mfg. Co., Cleveland, O. Electromagneticaly operated; not operated when current is excessive.

1,214,808. Method of Reducing Metals. R. J. McNitt, assignor to Roessler & Hasslacher Chemical Co., New York, N. Y. Metallic sodium is separated from its compounds by electrolyzing under high hydrostatic pressure.

1,214,816. Electric Lamp. M. S. Okun, New York, N. Y. Regulation of lamp having electrodes in contact under slight pressure during operation.

1,214,817. Means for Effecting Magnetic or Inductive Separation of Substance. S. W. Osgood, Chicago, Ill. Material carried on a belt is subjected to a magnetic field in which is a revolving armature.

1,214,830. Moisture Proof Switchboard Cord. W. L. Runzel, assignor to Runzel Lenz Electric Mfg. Co., Chicago, Ill. For telephone switchboards.

1,214,836. Battery Package. J. Smith, assignor to Hi-Po Waterproof Battery Corp., New York, N. Y. Dry cell structure.

1,214,841. Electric Furnace for Fusing Metals. J. Thomson, assignor to J. Thomson Press Co., Jersey City, N. J. Melting tank is heated by radiating carbon resistor.

1,214,842. Electric Zinc Distilling Furnace and Condenser for Producing Blue Powder. J. Thomson, assignor to J. Thomson Press Co., Jersey City, N. J. Has a radiating resistor suspended above the bath.

1,214,857. Train Coupling for Electrical Conductors. W. C. White, Los Angeles, Cal. Arrangement of electrical connections in a train pipe coupling.

1,214,861. Reversing Mechanism for Internal Combustion Engines. G. Wils, Mankato, Minn. Ignition contacts are changed with the valve control.

1,214,879. Electric Circuit Protecting Fuse. S. N. Baruch, assignor to Baruch Electric Controller Corp., San Francisco, Cal. Fuse for protecting windings of electrical apparatus is heated to change its capacity according to the heating of the windings.

1,214,883. Alternating Current Motor. D. M. Bliss, assignor to T. A. Edison, Inc., West Orange, N. J. Armature has squirrel cage and commutated windings.

1,214,900. Socket for Electric Lamps. J. Cuthbert, Chicago, Ill. Has a rotatable, ratchet controlled bushing for twisting the wires within the shell.

1,214,903. Fuse. L. W. Downes and R. C. Patton, assignor to D. & W. Fuse Co., Providence, R. I. Enclosed, with special gas vent.

1,214,909. Headlight Dimmer. C. B. Gamble and F. C. Shepard, Minneapolis, Minn. Has electromagnetically operated dimmer blades.

1,214,915. Service Box and Switch. M. Havens, Jr., and F. R. Meginniss, Albany, N. Y. Details of structure have a fuse in

one compartment and a switch in another.

1,214,920. Electric Switch. N. H. Holland, assignor to New Jersey Patent Co., West Orange, N. J. Details of push button operated device.

1,214,934. Electrolytic Gas Generator. I. H. Levin, New York, N. Y. Structural details of gas and electrode chambers.

1,214,956. Insulator. C. W. Rogers, Exeter, N. H. A split metal tube contains insulating bushings at its ends and center for supporting the line wire.

1,214,959. Illuminated Fountain Pen. E. O. Schaffer, Derby, Conn. Has battery lamp.

1,214,960. Method of Assembling Commutators. J. L. Schimmelfeng, Warren, Pa. For commutators with bars having dovetailed shanks with beveled ends, and tapered end rings.

1,214,969. Measured-Service Telephone System. S. S. Stolp, assignor to Automatic Electric Co., Chicago, Ill. Measuring device is operated by a magnet also adapted to operate as a buzzer to notify subscriber that he is on a measured service line.

1,214,980. Alternating-Current Motor. H. Weichsel, assignor to Wagner Electric Mfg. Co., St. Louis, Mo. Variable pole machine has commuted winding of greater pitch than pitch of greatest number of poles and smaller than that of smallest number of poles, and means for short circuiting the winding to render it indirectly responsive to more than one number of poles.

1,214,982. Automatic Telephone System. C. S. Winston, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. Arrangement of line, selector and connector switches.

1,214,989. Automatic Telegraphing or Radiotelegraphic Transmitter. E. Belin, Paris, France. Clock controlled mechanism for snding signals at any desired moment. ment.

1,215,001. Driving Attachment for Field Coils. F. J. Coupal, Buffalo, N. Y. Gearing details.

1,215,002 Telephone Apparatus. E. A. Cox, assignor of one-fourth to C. W. Thatcher, one-fourth to J. H. Bogart and one-fourth to B. F. Westlake, Dayton, O. Hook normally depressed by receiver in adjacent holder may be released therefrom by finger or foot operated push button.

1,215,004. Battery Connector. S. M. Decker, Malden, Mass. An insulator sheet fitting over dry cells carries conductors properly connecting the cells.

1,215,009. Cable Hanger. D. G. Edwards, Atlanta, Ga. Special structure of metal band for securing cable to messenger.

1,215,029. Shutter Means for Lamps. L. J. Jones and G. R. Monro, Toledo, O. Shutter inside lamp bulb is magnetically controlled from exterior.

1,215,037. Signal for Automobiles. D. J. Lanehart, Baltimore, Md. Electrically illuminated arm for direction indicator.

1,215,038. Telephone Circuit Arrangements. C. D. Lanning and S. C. Drew, assignors to D. D. Lanning, Boston, Mass. Metallic circuit has local reinforcing circuit operatively related to one side of the line.

1,215,042. Automatic Signal Device. G. C. Martin, assignor to J. M. Carson. Los Angeles, Cal. Motor oscillates a signal arm and electric lamp.

1,215,043. Searchlight. M. Matz, Mineola, N. Y. Battery device mounted on a band for attachment to a person's head.

1,215,060. Telephone Head Gear. T. Rhodus, Chicago, Ill., assignor to Magniphone Co. Operator's receiver support.

1,215,070. Street Car and Railway Indicator. E. H. Stacy, Atlanta, Ga. Motor operated rollers carrying indicator belt.

1,215,072. Condensation Product. C. P. Steinmetz, assignor to General Electric Co. Insulating compound; a non-inflammable resin consisting of a condensation product of monochlor-phenol and formaldehyde.

1,215,074. Insulating Gas Tight Seal. W. E. Story, assignor to General Electric Co. Structural details.

1,215,077. Machine for Waterproofing Fibrous Materials. A. O. Tate, assignor to Tate Electrolytic Waterproofing Co., New York, N. Y. Electrolytic process of rendering fibrous materials non-absorbent.

1,215,079. Candelabrum Socket. G. B. Thomas, assignor to Bryant Electric Co., Bridgeport, Conn. Structural details.

1,215,088. End Ring for Squirrel Cage Windings. F. M. Whitney, San Diego, Cal., assignor to General Electric Co. Details of construction.

1,215,094 and 1,215,095. System of Ship Propulsion. E. F. W. Alexanderson, assignor to General Electric Co. Arrangements for reversing when propeller motor is driven from a generator actuated by a prime mover.

1,215,116. X-Ray Apparatus. W. D. Coolidge, assignor to General Electric Co. Tube is rotated and discharge magnetically deflected to one side of axis, so that bombarded area of anode changes, thereby distributing the heating effect.

1,215,118. Electric Lamp. A. D. Cox, Winterville, N. C. Details of incandescent filaments and support therefor.

1,215,141. Electric Lamp Socket. G. W. Goodridge, assignor to Bryant Electric Co., Bridgeport, Conn. Relates to mounting of switch frame.

1,215,142. Film Winding Device for Cameras. J. P. C. Granger, Milwaukee, Wis. Gearing controlled by magnet in battery circuit controlled by push button.

1,214,879.—Fuse for Windings.

1,215,147. Arc Lamp. C. A. B. Halvorson and W. L. Harraden, assignor to General Electric Co. Arrangement of arc-enclosing globe and chimney.

1,215,150. Electrical Testing Apparatus. A. B. Hendricks, Jr., assignor to General Electric Co. For testing liquids.

1,215,155. Automobile Signal. C. McKeon, Hosford, Brooklyn, N. Y. Direction indicator.

1,215,157. Railway Gate Operator. D. E. Husk, Easton, Pa., and T. C. Copper, Newark, N. J. Circuit of operating motor is broken when gates are closed and gate retaining latch is released after certain time.

1,215,166. Timing Mechanism and Apparatus Involving the Same. J. M. Keller, Jr., Cleveland, O. Starting of apparatus sets time mechanism in operation, which, after certain time, operates switch terminating the operation of the apparatus.

1,215,169. Signaling Device. J. J. Kloepfer and C. F. Kloepfer, Springfield, O. Details of structure having illuminated, oscillating signal arm.

1,215,009.—Cable Hanger.

1,215,171. Sight Light for Firearms. C. A. Lewis, Portland, Ore. A tube carries adjustable lenses and an incandescent lamp having a central dark spot.

1,215,184. Induction Motor Control. C. A. Pauly, assignor to General Electric Co. Variable pole machine has two primary windings, one of which is supplied with alternating current for normal operation and the other with direct current for braking.

1,215,201. Electric Cable Attachment. J. A. Sandford, assignor to R. Thomas & Sons Co., East Liverpool, O. Cable jumper clamp.

1,215,203. Signal Device for Automobiles. L. L. Schmidt and T. W. Beuchel, Belleville, Ill. Has several electrically lighted signal compartments.

1,215,224. Starting Device. H. L. Van Valkenburg, assignor to Industrial Controller Co., Milwaukee, Wis. Details of magnet controlled mechanism for releasably holding a rheostat arm.

1,215,242. Circuit Closer for Automatic Signaling Systems. C. L. Bopp, Hawkeye, Iowa. Details of impulse operated mechanism.

1,215,245. Tie Wire for Insulators. R. L. Boyter, Lakeview, Tex. Special sheet metal structure.

1,215,249. Electric Switch Box. J. F. Burns, Philadelphia, Pa. Details of structure having knockout blanks.

1,215,263. Combined Fire Alarm Box and Hydrant. E. E. Ferguson, assignor of one-half to C. Van Fleming, Norfolk, Va. Box is placed in operative condition by removal of fire hose nozzle from its support.

1,215,272. Signal Apparatus for Motor Vehicles. P. R. Harsh, Toledo, O. Structural details of circuit closer.

1,215,274. Door and Glazing Retainer. E. A. Hawthorne, Bridgeport, Conn. For headlights.

1,215,289. Annunciator. O. M. Leich, assignor to Cracraft Leich Electric Co., Genoa, Ill. Structure of drop.

1,215,299. Lighting Fixture. E. J. Meyberg, Los Angeles, Cal. Semi-indirect.

1,215,309. Means for Charging Storage Batteries. S. G. Langley, assignor to New Jersey Patent Co., West Orange, N. J. Form an alternating source.

Reissue. 14,256. Insulator. W. H. Williams, Carey, O. Two-part reversible cleat for securing wires where they cross each other.

PATENTS EXPIRED.

The following United States electrical patents expired on February 13, 1917:

643,133. Safety Device for Electric-Distribution Systems. E. M. Hewlett, Schenectady, N. Y.

643,148. Electric Signal and Automatic Alarm for Railway Trains. J. K. Miller, J. W. Witt and D. A. Jones, Oshkosh, Wis.

643,162. Alternating-Current Meter. G. A. Schssffer, Peoria, Ill.

643,173. Target and Automatic Indicating Apparatus. J. H. van Vuersen, M. P. T. D. Moliere and C. E. Ter Meulen, Amsterdam, Netherlands

643.179. Thermostatic Apparatus. E. F. Woodman, Boston, Mass.

643,205. Switch. A. W. Rumsey, Detroit, Mich., assignor of one-half to P. Bingman, Detroit, Mich.

643,225. Telephonic Repeater. J. Houlchan, Toledo, O.

643,173. Target and Automatic Indicating the Supply of Electric Energy. C. R. Loubery, Paris, France, assignor to himself, E. Francois and H. Kunkelmann, Paris, France.

643.254. Electric Furnace. A. J. Peterson, Notre Dame de Briancon, France, assignor to the Societe des Carbures Metalliques, Paris, France.

643,255. Electrically Operated Day and Night Signal for Railways. T. J. Saville and J. H. Winspear, Omaha, Neb.

643,258. Motor Vehicle. E. A. Sperry, Cleveland, O.

643,276. Electric Traction Motor. C. Richter and R. T. Eschler, Camden, N. J.

643,283. System of Distribution for Electric Railways. W. Chapman, Washington, D. C., assignor to the Electromagnetic Traction Company of West Virginia.

643,309. Device for Disinfecting Telephones, etc. W. H. Taylor, Stamford, Conn.

643,327. Mine Trolley Hanger. G. E. Jamme, Jr., Pittsburgh, Pa.

643,367. Influence Machine. H. E. Waite, New York, N. Y.

643.379. Printing Telegraph. L. Kamm, London, England.

643,392. Electric Meter. J. H. Barker and J. E. Ewing, Cambridge, England.

643.395. Lamp Shade. E T. Berggren, St. Paul, Minn.

643,401. Electric Flashing Switch. A. L. Cotter, Cleveland, O.

643,405. Burglar Alarm. J. T. Friend, Fort Wayne, Ind.

643,413. Electromagnetic Variable-Speed and Clutch Gearing. R. Kennedy, Leeds, England.

643,414. Surface-Contact Stud for Electric Traction. W. Kingsland, London, England.

643,442. Controller. T. von Zwiegbergk, Cleveland, O.

643,484. Microphonic Transmitter. G. F. Dupont, Paris, France.

643,491. Pyroxylin Automatic Electric Fire Alarm. J. de Froment, Notre Dame de Lourdes, Canada.

643,501. Trolley. W. G. Holmes, Roseville, and H. Holland, Detroit, Mich.

643,506. Electric Clock. H. Iverson, Corsicana, Tex.

643,513. Igniter for Explosive Engines. F. J. Macey, Ontonagon, Mich.

643,545. Telephone Telegraph. A. Sinding-Larsen, Fredriksvaern, Norway.

643,609. Signaling System. J. T. Ruddick, Newton, Mass.